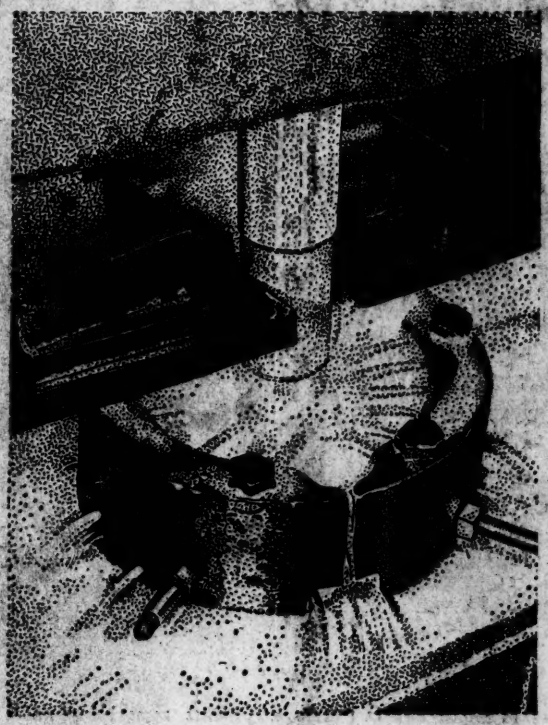
V201 JAN 47 XUM

Metals Review

VOLUME XX •• NO. 1 PUBLISHED BY THE AMERICAN SOCIETY FOR METALS JANUARY 1947

HEAT TREATING ISSUE



Featuring

Heat Treating

Additions to Metallurgical Knowledge During the Past Year

By George K. Manning
Assistant Supervisor, Process Metallurgy Div. Battelle Memorial Institute

A critical appraisal of developments during recent months as described in the literature. Based on the "Review of Current Metal Literature".

Products and Processes for Heat Treating

A review of equipment, materials and methods developed during the past twelve months, as described by the manufacturers.

NOTABLE LECTURES

Reported This Month

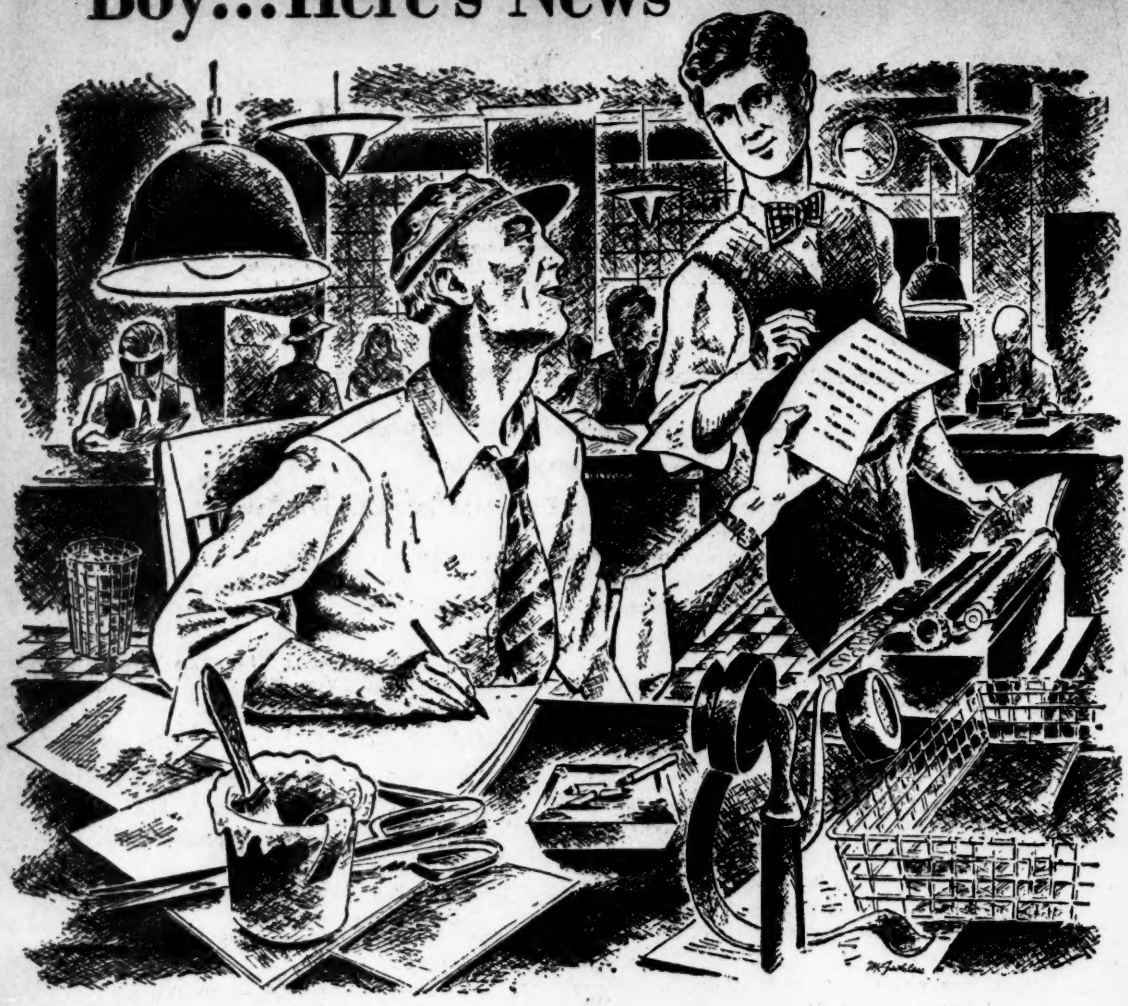
Koebel tells how furnace atmospheres do jobs of machines and reviews advances in equipment design . . . Heuschkel discusses problems of heat flow and quench rates in spot and flash welding . . . Harvill gives die-casting practices for various alloys . . . W. W. Matlack and O. B. Wilson see pyrometric progress as sum of many small advances . . . McDonald shows how properties of magnesium adapt it to monocoque design . . . Spade illustrates superiority of alloy steels by citing their applications in Los Angeles industries.

READ • CHECK • PASS ON

- ☐ Management
- ☐ Metallurgical
- ☐ Production
- ☐ Research
- ☐ Engineering
- ☐ Library

COMING NEXT MONTH — NONFERROUS ISSUE

Boy...Here's News



Washington, Pa., January 6 (Special)—The Washington Steel Corp. is ready to accept inquiries for MicroRold Stainless Steel Sheet and Strip. MicroRold is precision cold rolled stainless steel processed by a unique new practice producing stainless alloys in the continuous coil form—Modern Practice for the Modern Metal. Washington's new mill, devoted entirely to flat-rolled stainless steels, will produce substantial tonnages of sheet and strip up to 36 inches in width and in gauges from .004 to .078 inch in commercial tempers and finishes.

Washington Steel Corporation's new mill, novel in design, operation and practice, produces a final outstanding stainless steel product. Advantages to the fabricator are exceptional physical properties, better surface quality, and improved corrosion resistance. In addition, MicroRold offers users of flat-rolled stainless steel sheet and strip a product remarkably uniform to gauge throughout its entire cross-section and length. Naturally, this means more area per ton of steel.

WASHINGTON STEEL CORPORATION

WASHINGTON, PENNSYLVANIA

District Offices

HARTFORD
36 Pearl Street
Hartford 7-7028

DETROIT
2565 Guardian Building
Cherry 0905

CHICAGO
Room 855
141 West Jackson Boulevard
Harrison 1682

Metals Review

Vol. XX, No. 1

Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, Alfred L. Boegehold, President; Francis B. Foley, Vice-President; William H. Eisenman, Secretary; Harold K. Work, Treasurer; Arthur E. Focke, John E. Dorn, Walter E. Jominy, John Chipman, Trustees; Charles H. Herty, Jr., Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930, at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

January 1947

RAY T. BAYLESS, Publishing Director MARJORIE R. HYSLOP, Editor GEORGE H. LOUGHNER, Production Manager

Table of Contents

Heat Treating Section

Heat Treating—Additions to Metallurgical Knowledge During the Past Year, by George K. Manning 5
A critical appraisal of developments as described in the literature

Products and Processes for Heat Treating 9
Some Recent Innovations Described by the Equipment Manufacturers

Lectures Reported

Furnace Atmospheres Do Jobs of Machines—Norbert K. Koebel . . 21
Conveyers and Manipulaters Make Salt Baths Automatic—A. F. Holden . . 23
Los Angeles Industries Illustrate Superiority of Alloy Steels—James H. Spade 27
How Magnesium Is Adapted to Monocoque Design—John C. McDonald . 29
High Speed Vs. High-Carbon, High-Cr Steels for Dies—Leonard C. Grimshaw and Ray P. Kells 33
Acid Steelmaking Traced—George S. Baldwin and Edward E. Callinan . . 33
Pyrometric Progress Seen as Sum of Many Small Advances—W. W. Matlack and O. B. Wilson 35
Behavior of Each Alloy Element in Carburizing Shown—A. S. Jameson . . 35
Corrosion and Pitting Are Main Problems in Power Plants—P. M. Hess . . . 37
Bulk of Railroad Failures Caused by Faulty Design or Poor Quality Material—Charles B. Bryant 39
Die Casting Inventions, Practices for Various Alloys—H. L. Harvill . . . 41
Heat Flow and Quench Rates Affect Spot and Flash Welding—Julius Heuschkel 43

News of the Industry

Western Metal Congress Technical Program Has More Than 75 Papers Scheduled 23
Appointments to A.S.M. Standing Committees 25
Frohman Named General Sales Engineer for Ampco 43
New Stainless Foundry Organized in Milwaukee 45
Pictorial Review of Metal Show Personalities 50, 51

Departments

Meeting Calendar 47
Employment Bureau 49
New Products in Review 52-55
Reader Service Coupon 53
Advertising Index 54

Review of Current Metal Literature

Analysis 22
Cleaning and Finishing . . . 18
Corrosion 16
Design 44
Electroplating 20
Foundry Practice 28
Furnaces and Fuels 30
Heat Treatment 32
Industrial Uses 42
Inspection 26
Laboratory Apparatus . . . 24
Lubrication and Friction . . . 38
Machining 34
Materials Index 48
Miscellaneous 44
New Books 46
Ores and Raw Materials . . . 10
Powder Metallurgy 14
Properties of Metals 12
Refractories 30
Salvage and Secondary Metals . 30
Smelting and Refining . . . 10
Statistics 46
Structure 14
Temperature Measurement and Control 26
Testing 22
Welding 38
Working 32

AMERICAN SOCIETY FOR METALS

'Surface'

—for every heating and heat treating need.

STANDARD RATED EQUIPMENT

Oven Furnaces
Atmosphere Furnaces
Pot Furnaces
Metal Melting Furnaces
Convection Furnaces
Air Heaters
Industrial Gas Burners
Immersion Heating

SPECIAL PROCESSES AND EQUIPMENT

Radiant Tube Firing with Prepared Atmospheres

Gas Carburizing
Carbon Restoration (Skin Recovery)
Suspended Carburization
Clean and Bright Atmosphere Hardening
Bright Gas-Normalizing and Annealing
Dry (gas) Cyaniding
Bright Super-fast Gas Quenching
Atmosphere Malleableizing
Atmosphere Heating for Forging
Prepared Gas Atmosphere Generators

Direct-Fired Furnace Equipment

Continuous Type
Batch Type

Write for free descriptive bulletins on equipment and processes of your interest.

SURFACE COMBUSTION CORPORATION
TOLEDO 1, OHIO

Heat Treating—

Additions to Metallurgical Knowledge During the Past Year

By G. K. Manning

Assistant Supervisor, Process Metallurgy Division
Battelle Memorial Institute

IT IS SELDOM that a metallurgical concept or idea will be born and grow to maturity within the course of a single year. Usually, this process requires several years. Not until considerable time has elapsed is it certain that a concept will survive its infancy and eventually assume its place in the house of metallurgical philosophy. Metallurgical concepts have a higher infant mortality rate than do humans. In reviewing the work of any one year in metallurgy, one then sees a number of different ideas in different stages of development. Most certainly, some of the infants will not be with us a few years hence. Others appear as lusty adolescents just beginning to feel their oats, and still others begin to assume the dignity of maturity.

These concepts are the building blocks from which is constructed our house, the science of metals. The furnishings of the house are the commercial applications which have been made in the field of industry. It is the first obligation of metallurgists to reinforce and enlarge the house by fitting into the structure new building blocks as they become known—for what good are pretty furnishings if the walls crack or the floor breaks through or the roof leaks? With this in mind, most of this review is given to describing the building blocks (or concepts) noted in the literature this past year.

Austenite Decomposition

It is gradually becoming apparent that some of the concepts relating to the decomposition of austenite, which developed just prior to the war and during the first years of the war, represented an oversimplification. Kramer, Siegel, and Brooks (18-155, August 1946)*, continuing the studies of Grossmann and others by attempting to determine adequate factors for use in calculating hardenability, found that all alloying elements are *not* independent of one another in their effect on hardenability as was originally postulated by Grossmann. The strong carbide-forming elements, particularly chromium and molybdenum, were found, when simultaneously present in steel, to have an interaction which serves to decrease their individual effects. Furthermore, these same authors found that, contrary to the assumptions of early investigators, the relationship between ideal critical diameter and the percentage of any single alloying element is not always linear.

In view of the general disagreement among different investigators who have recently attempted to determine hardenability factors, it may be questioned whether calculated hardenability should be treated as more than a laboratory curiosity. The investigations with calculated hardenability have served to emphasize that the problems of many metallurgists would be considerably simplified were it possible to calculate hardenability accurately from the chemical analysis, and they have also given impetus to the study of quantitative hardenability initiated by Burns, Moore, and Archer in the late thirties. However, the disagreement in these more recent papers gives warning that the mathematical treatment of hardenability is a complex subject and that quite a few years will elapse before plant metallurgists can combine a series of factors based on chemical analysis and come up with an answer of which they can be confident. In the meantime, if a metallurgist wants to know the hardenability of a steel, the sure way of determining it is by making an actual hardenability test.

Hollomon and Jaffe (18-54, April 1946) have suggested that our concept of hardenability should include a consideration of the nature of the transformation product which may limit the attainment of full hardness. Thus, if a steel fails to harden because it transforms in the pearlitic temperature range, the authors would consider "pearlitic hardenability" as the controlling factor. On the other hand, if incomplete hardening leads it to transform in the bainitic temperature range, the authors would consider "bainitic hardenability" as the controlling factor. The authors give insufficient emphasis to the fact that the formation of bainite and pearlite in medium-carbon steels is likely to be preceded by the formation of ferrite. However, since there is some suggestion that bainite and pearlite are each preceded by an individual type of ferrite formation (18-154, August 1946), their arguments are probably valid. "Pearlitic hardenability" and "bainitic hardenability" are additional worries for those attempting to calculate hardenability from the chemical analysis, but are of little concern to the plant metallurgist relying on actual tests to determine hardenability.

Manning (18-226, November 1946) has pointed out that the use of Jominy hardenability data to predict the hardness and microstructure at the interior of rounds more than 2 in. in diameter may not be as simple as has been assumed. A given steel may develop somewhat different microstructures and hardnesses when quenched after similar austenizing conditions, even though the quenching rate is substantially similar. Apparently, the mass of the specimen has an effect on transformation that goes beyond the well-known effect of mass on cooling rate. The author postulates that thermal and allotropic stresses established during the quenching of a part may affect the transformation characteristics, tensile stresses serving to advance transformation and compressive stresses serving to inhibit transformation. Specimens somewhat less than 2 in. in thickness seem to be unable to support stresses of sufficient magnitude to influence transformation materially, but as the mass of the specimen is increased beyond 2 in., the effect becomes conspicuous. Thus, the scales frequently included on Jominy hardenability sheets, showing the diameter of round with similar cooling rates, cannot be used with impunity. If one wishes to be certain of the microstructure and hardness that will be obtained from a particular steel when made into a commercial part, the sure way of determining it is to make up such a part and harden it by the same procedure to be used in the plant.

The location of the 50% martensite position, which plays an important part in the hardenability concepts developed by Grossmann and his collaborators, though being easy to locate either by fracturing, deep etching, or hardness measurements, has the disadvantage that very seldom is one really interested in the position which contains 50% martensite. Instead, one is frequently interested in knowing at what position the structure is substantially *all* martensite. Hodge and Orehoski in two papers (18-224, 1945 volume†, and 18-108, June 1946) have studied the relationship which exists between locations containing 50% martensite and those

*Literature references are designated by the corresponding item number in the Review of Current Metal Literature rather than by repeating the entire title, author and source; the reader can get this information by referring to *Metals Review* for the month indicated.

†"1945 volume" represents Volume II, 1945, of the Review of Metal Literature, assembled and bound from the monthly installments published in *Metals Review* for that year.

containing 95 and 99.9% martensite. They found that this relationship is influenced by the carbon content, but is substantially independent of the amount of alloys present. There is a larger proportionate distance between locations containing 50% martensite and, say, 95% martensite in steels having a carbon content of 0.20% than in steels with 0.50% carbon. Thus, a low-carbon alloy steel having the same nominal 50% martensite hardenability as some high-carbon lower alloy steel will harden to a completely martensitic structure only in sizes much smaller than the high-carbon steel.

Metallurgists in the past few years have become accustomed to thinking in terms of Jominy hardenability tests and also in terms of TTT diagrams. It is generally recognized that these two metallurgical tools deal with precisely the same phenomenon, namely, the decomposition of austenite. But no adequate relationship between them has been developed. Two papers of the past year, one by Hollomon, Jaffe, and Norton (4-75, October 1946) and another by Manning and Lorig (18-154, August 1946) have examined this relationship. It has become clear that conclusions reached simply by imposing a cooling curve on a TTT diagram are likely to be very much in error. It has also become apparent that different modes of nucleation must receive special consideration, but the authors of the two papers are not in complete agreement as to just how the different modes of nucleation should be handled.

There is a great need for additional work in this field. Information that may be obtained concerning the relationship between hardenability tests and TTT diagrams does not hold much promise of leading to any startling industrial application, but it is important because such information will affect the metallurgist's way of thinking about austenite decomposition.

The temperature range of martensite formation has been studied by Grange and Stewart (18-153, August 1946). Recent information that quench-crack sensitivity is closely related to the temperature at which martensite begins to form, and the recent commercial use of martempering treatments, have increased the importance of this subject. The authors in their study of very small specimens found that carbon tends to increase the temperature spread that exists between the start and finish of martensite formation (M_s and M_f temperatures, respectively). Steels containing 0.10% carbon have a martensite formation range of only 130° F., while steels containing 1% carbon transform to martensite over a temperature range of 300° F. Evidence was also presented that undissolved carbides tend to raise the entire range. In S.A.E. 52100 steel, the martensite formation range is 200° F. lower when all carbides are in solution than when the steel is quenched from below its A_{cm} temperatures. The work of Grenninger (*Transactions* ASM, V. 30, 1942, p. 1 to 26) and Payson and Savage (*Transactions* ASM, V. 33, 1944, p. 261 to 280), to the effect that austenitic grain size does not influence the temperature at which martensite is formed, was confirmed. Grange and Stewart now interject a word of caution about attempting to apply the results directly to commercial parts.

All of their tests were carried out on small specimens, and there is some suggestion that the martensite formation range may be decidedly affected by the mass of the specimen. Literature published during the late twenties indicates that large rounds may contain, after quenching, more retained austenite than small rounds of the same steel, and that oil quenching retains more austenite than water quenching. Thus, one might conclude that, as the mass of the part increases, the temperature of martensite formation decreases and, again, that as the cooling rate is decreased, the temperature range of martensite formation is decreased. Carrying this same line of reasoning a little further, one may wonder if martempering treatments themselves do not tend to result in more retained austenite than direct quenching to room temperature.

Udy and Barnett* have called attention to the relationship between susceptibility of medium-carbon steels to quench cracking and the martensite formation temperature range. Increasing the carbon content of a part markedly increases the susceptibility of the part to quench cracking, since raising the carbon lowers the M_s temperature. Other alloying elements affect quench-crack sensitivity in proportion to their effect upon the M_s temperature. Since most of the common alloying elements tend to lower the M_s temperature, they also tend to increase this sensitivity.

Boron seems to be a noteworthy exception. It appears that the small amounts of boron (0.001 to 0.003%) added to steel to increase the hardenability do not affect the M_s temperature, and consequently do not affect quench-crack susceptibility. If true, here is one element which may be used to increase hardenability without inviting additional trouble from quench cracks. Jaffe and Hollomon (18-55, April 1946) have continued the line of reasoning proposed by Udy and Barnett and worked out balanced additions of different alloying elements which should minimize the tendency toward quench cracking for any given degree of hardenability.

Arend and Mintrop (18-185, September 1946), in a thought-provoking study, indicate that different quenching mediums may give fast cooling rates in different temperature ranges. If plain carbon steels are being used, wherein the depth of hardening is controlled by the speed with which one is able to cool to below approximately 1000° F., then it is an advantage to use a quenching medium which has a fast cooling rate between approximately 1300 and 1000° F. but as slow a cooling rate as possible below this temperature range. Thus, one may achieve maximum hardening and a minimum tendency to quench crack. Relatively slow cooling below 1000° F. would give the same advantages associated with martempering. The depth of hardening of many alloy steels, however, is controlled by the speed of cooling through the bainitic temperature range (below 1000° F.). If maximum hardening is to be obtained from such steels, it is necessary that the quenching medium cool the part rapidly while it is passing through this lower temperature range. The quenching medium should therefore be chosen with a view to the type of alloy steel being quenched. Rather massive parts may require a fast quench almost to room temperature, since the center temperature shortly after the start of the quench may be several hundred degrees higher than the surface temperature. Thus a quenching medium with still different characteristics would be advantageous for massive parts.

The cooling curves developed by different quenching mediums appear to deserve more study than they have so far received. There is no reason why the quenching of commercial parts should be restricted to the use of either water or oil. New kinds of quenching mediums, possibly containing large quantities of dissolved salts or possibly oil-water emulsions, hold forth the promise of controlling cooling rates within different temperature ranges so as to obtain maximum hardening with minimum cracking.

Hafsten (18-184, September 1946) has pointed out that if one is concerned principally with maximum hardenability, the presence of undissolved carbides just prior to quenching is quite undesirable. Undissolved carbides lower hardenability, first, because they remove both carbon and some "purchased" alloying element from solution where it may serve to benefit hardenability and, second, because such undissolved carbides act as nuclei which advance transformation during cooling.

The influence of microstructures on the mechanical properties of steel has been summarized very nicely in a paper by Hollomon, Jaffe, McCarthy, and Norton (4-111, December 1946). The authors point out that steels having tempered martensitic structures possess superior mechanical properties to those with other structures, such as tempered martensite plus pearlite, tempered martensite plus ferrite, or tempered martensite and bainite. For a given tensile strength, specimens whose microstructure was 100% tempered martensite possessed the highest yield strength, the highest ductility, the highest endurance limit, and the highest V-notch Charpy values. The rate of strain

*"A Laboratory Study of Quench Cracking in Cast Alloy Steel", by M. C. Udy and M. K. Barnett, paper for 1946 ASM convention, to be published in *Transactions* for 1947.

hardening, however, was found to be substantially independent of the microstructure. These same conclusions were implied, at least, by other studies of the past several years, but the authors, by making a rather impressive number of objective tests, have done much to formalize the conclusions.

Those interested in the role which hydrogen plays in steel metallurgy will not wish to overlook a comprehensive paper by Andrew, Lee, Mallik, and Quarrell (18-145, July 1946)*. Though many of the authors' conclusions can hardly be termed new, both the quantity and the quality of their work are impressive. They found that, in the absence of thermal stresses, hairline cracks (fissures) may be formed in steels containing dissolved hydrogen. Thermal stresses merely accelerate the formation of hairline cracks and control the pattern that the cracks assume. Hydrogen evaporated at a rapid rate while the steel was transforming either in the pearlitic temperature range or in the bainitic temperature range, as might be expected in view of the decidedly lower solubility of hydrogen in ferrite than in austenite.

The war years have witnessed a considerable increase in the percentage of steel castings which are quenched and tempered before being put into service. The O.S.R.D. Committee on Steel Castings (18-189, October 1946) has discussed some of the recent procedures used in heat treating steel castings and also the acceptance by the foundry industry of the Jominy hardenability test. Rosenthal and Manning (18-175, September 1946) discussed the limitations that apply to the use of large amounts of alloying elements in massive castings which are to be heat treated. As the amounts of alloying elements are increased, the tendency for irregularly shaped massive parts to crack during quenching is also increased. The generous use of alloying elements also tends to increase temper brittleness and to require long annealing cycles if the casting must be machined before being hardened. Some massive castings therefore must contain some bainite, even though it is known that bainite is, to a certain extent, detrimental to the mechanical properties of the piece.

Induction Heating

The principles of induction heating have been known and understood since the turn of the last century, and these principles have been applied to the melting of various metals for somewhat more than a quarter of a century. Yet there has been witnessed during the war years, and even during the past year, a remarkable growth in the commercial application of these principles. This growth in the use of induction heating has applied not so much to the melting of metals as to the heat treatment of steel—induction hardening as it is commonly termed. There is every indication that induction hardening will continue for the next several years to find worth-while applications in the heat treatment of commercial parts. Judging by the large number of technical articles that have appeared on the subject during the past year, metallurgists, a few years hence, will have to use such terms as farads and frequencies as readily as they use such terms as austenite and ferrite today.

George K. Manning Has Been Closely Identified With Developments in the Heat Treating Field Since 1937, When He Began a Study of the Heat Treatment of Graphitic Steel as His Thesis for a Master's Degree From University of Michigan. From 1939 to 1943 he was metallurgist at the Chicago plant of Republic Steel Corp. He joined the staff of Battelle Institute as a research engineer in 1943. He is the author of numerous technical papers.

The original cost of installing induction hardening equipment is usually somewhat greater than the cost of comparable equipment heating by convection or radiation, but the advantages of induction hardening frequently offset the higher initial cost. Close (18-91, May 1946) has noted a number of these advantages. Induction hardening equipment may be located within the production line and, thus, a great deal of handling, storage, and scheduling is eliminated. Because of the high rates of heat input, scaling and decarburization cease to be difficulties. Automatic timing of the entire heating and quenching cycle permits the use of untrained and inexperienced help. Once the proper cycles have been established, they are repeated time after time very precisely; for this reason, straightening costs are drastically lowered. The higher cost of the equipment may be partially offset by the use of lower alloy steels.

The source of power is the standard 60-cycle alternating current, feeding into motor-generator sets producing frequencies up to 30,000 cycles per sec., or else into spark-gap oscillators generating frequencies as high as 500,000 cycles per sec., or even into vacuum tubes generating frequencies as high as 10,000,000 cycles per sec. An article by Osborn, Fox, and Cable (18-238, 1945 volume) emphasizes that these different sources of power each have their own field of application.

Cady (18-193, October 1946) and Nielson (18-71, April 1946) have noted that unaltered 60-cycle alternating current, which is available in nearly every industrial plant in the country, may satisfactorily be used for heat treating certain types of parts; where pieces at least 1 in. in diameter (preferably several inches in diameter) are to be heated throughout their sections and where short heating times and high temperatures are not a requirement, direct connections to a standard power line may be satisfactory. The cost of such equipment is, of course, exceedingly low, but the experimental work necessary for designing such equipment is usually high, at least several times the cost of the equipment itself.

Motor-generator sets producing considerably higher frequencies, but still rather low in comparison with the frequencies obtained from vacuum-tube equipment, are commonly used for melting. Low frequencies may also be used to advantage in induction hardening where the hardened zone is to be fairly deep with relation to the mass of the part. Spark-gap oscillators may be used for melting small heats of steel (say, up to 50 lb.), or for induction hardening of parts—especially of irregular contour—where a thinner hardened zone must be obtained.

Stansel (18-27, March 1946) points out that where very thin hardened skins are necessary, one must use high-frequency vacuum-tube equipment as a source of power. The ability of high frequency currents to concentrate the heat input within a small area is quite remarkable. Copper tubing (with its high thermal conductivity) of ⅛-in. wall thickness may be melted by currents of 2 or 3 million frequency at a point only ½ in. from where the tubing is immersed in water. Superficial heating may remove the necessity of water quenching the part at the end of the heating cycle, for skins of about 0.05 in. in thickness can be successfully self-quenched by the cold interior metal of the part.

In spite of the rather spectacular localized heating achieved by vacuum-tube induction equipment, Poynter (18-261, 1945 volume) suggests that the effect of frequency may have been overemphasized. Heat flow by conduction

*See also a summary of French work on this subject in the December 1946 issue of *Metal Progress*, p. 1206.

within the part operates to oppose the severe local heating obtained with vacuum-tube circuits. To overcome the effect of heat conduction, it is necessary to go to extremely high power inputs. This, in turn, introduces some new difficulties. Therefore, practical considerations already seem to be imposing restrictions on the thinness of skin that may be induction hardened.

As might be expected, the prior microstructure of a part to be induction hardened is more important than is the prior microstructure of parts to be hardened after heating by convection or radiation. Martin and Van Note (18-258, 1945 volume) state that the ideal prior structure of the part to be induction hardened is one containing no free ferrite and a uniform distribution of fine carbides. This is quite reasonable because the finer the metallographic structure, the less carbon diffusion is necessary in order to produce a structure sufficiently homogeneous to insure satisfactory properties. There is also some advantage in using steels having a low critical temperature to permit slightly shorter heating cycles or slightly lower power inputs.

The past year has witnessed the debunking of some of the mysticism surrounding induction hardening treatments. Not infrequently the thought has crept in that, when a piece is heated by induction, the molecules take part in some strange exotic conga which imparts unusual properties. One sometimes hears that supertoughness, superhardness, and terrifically fast austenizing rates are but evidence of that strange molecular dance. It now appears that there is nothing mysterious about induction heating; induction heating accomplishes nothing that could not be accomplished by other means were there other methods capable of so rapidly introducing heat into metals. It is true that higher hardnesses of 2 to 5 numbers on the Rockwell C scale may be obtained from induction hardened parts than from conventionally hardened parts, but Martin, Van Note, and Poynter (18-258, and 18-261, 1945 volume) agree that the chief reason for this superhardness is connected with the severe compressive stresses present at the surface. Martin and Van Note suggest there may be special cases where the superhardness can be partially attributed to a very fine martensite or to less retained austenite than results from conventional treatments.

Strickland (18-178, September 1946) has described the use of induction heating for brazing. He points out that this application fitted in very nicely with the production of a number of ordnance parts during the war years, and it should find a counterpart in the production of peacetime articles.

Cady (18-193, October 1946) points out that induction heating may be used as an inspection tool; heating currents tend to concentrate around any discontinuities present in the part being heated. Concentration of heat around such defects may cause actual melting, and at other times open up the defects so they become clearly visible on the surface.

An electronic blowtorch has been described (18-298, 1945 volume) in which ultra short radar waves are concentrated upon a metal part in order to produce very rapid heating. With such equipment it is not necessary to design a separate coil for every part, as must be done with induction heating at audio frequencies. Such equipment is not yet available for commercial use.

Overheating

A series of British papers has contributed to our knowledge of overheated forgings. Merchant (18-134, July 1946) has made a distinction between burnt and overheated steel forgings. Burnt steel will exhibit black fractures if broken, show an intergranular network of oxide if examined metallographically, and develop a network pattern which corresponds to the intergranular oxides to be seen by metallographic examination when deep etched. Steel that is actually burnt will invariably have low ductility when tested as tensile specimens and be extremely notch sensitive if tested as Charpy specimens. Overheating, however, may affect only slightly such mechanical properties of the steel. Fractured specimens of overheated steel show large metallic-appearing facets, yet it is quite difficult to find any evidence of the prior overheating by deep etching techniques or metallographic examination.

Preece, Hartley, Mayer, and Nutting (18-110, June 1946) state that the difference between overheating and burning is not simply a matter of degree. They have found that overheating does not involve fusion or melting of the nonmetallics present in the steel, that there is no evidence of crystals having been separated by the release of dissolved gases, and that overheating is not influenced by the furnace gases—for example, highly oxidizing furnace atmospheres do not promote overheating. On the other hand, the temperature range which results in evidence of overheating varies, steel to steel, being connected with a diffusion process within the austenite grains. A critical cooling rate from the forging temperature increases the degree of overheating that may be observed by subsequent fracture tests. Electric furnace steels were found to possess a lower overheating temperature range than do openhearth steels; and strangely enough, the authors also found that clean steels—those possessing the fewest inclusions—have lower overheating temperature ranges than relatively dirty steels. They suggest that overheated steels may be reclaimed by reheating them to the forging temperature and cooling very slowly.

Woolman and Kirkby (18-137, July 1946) agree with Preece, Hartley, Mayer, and Nutting that the overheating phenomenon is a diffusion and precipitation process which occurs, not at the forging temperature, but while the steel is being cooled from this temperature. They also observed that different melts of the same nominal composition possess different overheating temperature ranges. However, they have so far been unable to establish the identity of the precipitate. There seems to be a remarkable similarity between the results of these British studies and the results of several studies made in this country during the war years under the auspices of O.S.R.D.

Carburization

The formation of massive carbides in carburized cases has been studied by Breitbart (18-241, 1945 volume). He found that massive carbides which represent carbon contents in excess of that indicated by the A_{cm} line were not formed in the absence of carbide nuclei. The tendency for steels containing chromium and molybdenum to develop such massive carbides during carburization is attributed to the very stable complex carbide particles which are likely to persist undissolved in such steels for some time after they have reached the carburizing temperature. It was suggested that the carburizing potential of the carburizer controls the maximum carbon content of the case until it reaches a concentration corresponding to the A_{cm} line of the steel. Breitbart concludes that the carbon content of the case cannot exceed this point unless there are present, in the steel carbide, nuclei to serve as precipitation centers. According to the author, it is possible commercially to avoid the formation of massive carbides by a few simple precautions.

Jenkins (18-158, August 1946), in testing the gases present in carburizing boxes containing commercial pack carburizers, found that hydrogen, as well as carbon monoxide, plays a major role. He suggested that the hydrogen comes from water vapor absorbed in the capillary pores of the carburizing compound. Gas carburizers were also studied, and it was found that a mixture made by passing city gas over charcoal at 1800° F., and then adding 2% propane, had a high carburizing potential and did not lead to soot formation during the carburizing cycle. City gas, not exposed to incandescent charcoal, required a 25% addition of propane before it became carburizing in nature, and such mixtures resulted in heavy soot formation.

Boyer and Miller (18-79, May 1946) have extended Cohen and Fletcher's work on toolsteels to carburized alloy steels. They found that refrigerating carburized specimens immediately after cooling to room temperature transformed the residual austenite in the carburized cases of some alloy steels. This transformation, in some instances, led to an increase in hardness from Rockwell C-59 to C-64, and increased the dimensional stability of the part.

PRODUCTS AND PROCESSES
for Heat Treating
Some Recent Innovations Described by the Equipment Manufacturers

ADAPTABILITY, production-line installation, portability, economy of operation, and, above all, better methods of heating, have served as the goals of the heat treating equipment manufacturers during the past 12 months. Greatest strides toward attaining these goals are reflected in the commercial developments recorded by the manufacturers of salt bath furnaces and salts, gas carburizing units, induction heaters, gas and oil burners, general utility furnaces—both large and small—and precision electrical equipment.

Salt Baths

In the field of salt bath equipment particularly, measurable progress has been made in the attainment of all of these goals except the one of portability. Flexibility and economy of operation are evident in A. F. Holden Co.'s new "Marquenching" unit (R-101).* Novel feature of this furnace is positive forced circulation with motorized pump, eliminating the use of conventional stirrers.

Definite methods of filtering out solidified salt carried over from the hardening bath, scale and any other products which would retard the quenching rate are also provided. Because the stream of the liquid is from the bottom, the heated liquid in contact with the parts being hardened is removed to the upper surface where it is cooled in the trough as it returns to the sump area.

In the sump area there is a pump and underneath the spillway is located an air stream into which is blown 16 oz. of air pressure in sufficient volume to cool the salt to the desired temperature for return to the pump. The volume of air may be from 100 to 12,000 cu.ft. per hr., depending on the application. The air stream and the area where the work is quenched are automatically controlled so that uniformity of hardness and temperature is maintained.

This type of unit can be built to any size. The number of pumps is dependent on the size of the furnace and two or more are used on larger installations. A minimum of 30 and a maximum of 60 gal. of salt per min. can be circulated. The furnace can be heated by immersed electrodes, by resistance calrod units, or by under-fired gas burners.

Another Holden development (R-102) has been the use of conveyers and manipulaters to render salt bath heat treating lines completely automatic.

A conveyerized unit for cyanide treating the threaded ends of automotive parts has been devoloped by Dempsey Industrial Furnace Corp. (R-103). The parts are hung on the special fixture shown in the right of the photo below and are carried on the monorail conveyer to a position over the immersed electrode furnace shown at the left. An elevator lowers the rack to a point where the threaded portion of the part is immersed. After sufficient time at temperature the elevator is raised and the loaded rack of work is carried into a quench section where a second elevator lowers it into a water quench.

Marquenching Furnace

After the quench, the lever shown on the end of the rack is turned over 180°, thus reversing the parts so that the opposite end is down. They are then placed in a second furnace similar to the first (not visible in the photograph), and then are moved into a second quench tank (shown at the right).

The unit is capable of high production with a minimum of operating labor and the depth of immersion in the salt bath is readily controlled by means of an adjusting lever. Selective heat treating and casehardening can be obtained to produce the desired physical properties in the threaded portion of the part.

Dempsey also has an immersed electrode salt bath for heat treating stainless steel cutlery blades (R-104), in which heat losses from the exposed top surface of the bath are eliminated by provision of a cover mounted on ball bearing wheels so as to be readily movable.

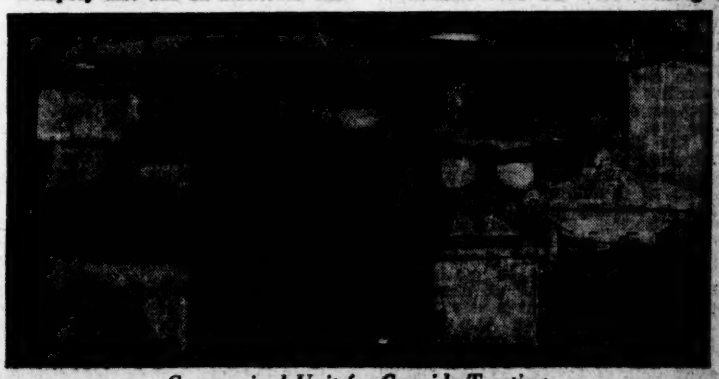
A method of automatically renewing electrodes sealed in the bottom of a salt bath furnace has recently been announced by Upton Electric Furnace Division (R-105). Electrodes are made "self-perpetuating" by reduction of the metallic oxides normally contained in the bath. On each side of the pot and immediately above each electrode is a ledge or overhang of refractory material. A graphite rod is inserted beneath each of these ledges and, being of lower specific gravity than the salt, is held there by its buoyancy.

As the oxides contact the graphite rod, they are reduced to the metallic state and form a metallic scale on the rod. Contact with the carbon rod increases the carbon content of this metallic scale and reduces its melting point until the scale melts and drops from the rod. Since the rod is immediately above the electrode, the metal falls on the electrode. Here the oxides in the bath will again reduce the carbon and the metal becomes a solid, integral part of the electrode itself. This process continues automatically until the carbon rod has been consumed, when a new rod can be inserted under the ledge.

Liquid Carburizing

New salt compositions include several developed for liquid carburizing. Karbo-Kasing (Park Chemical Co., R-106) consists of introducing a small flow of oxygen gas into a salt bath containing cyanide and operated with a carbon cover. Passage of the gas through the molten salt provides a mild agitation which contributes to uniformity of results.

The salt used for Karbo-Kasing is



Conveyerized Unit for Cyanide Treating

*Further information about the products described may be secured by using the Reader Service Coupon on page 53 specifying the appropriate R-number, or by writing direct to the manufacturer at the address given on page 19.

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month

1 ORES & RAW MATERIALS Production; Beneficiation

1-74. Settling and Thickening. Fred C. Bond. *Canadian Mining and Metallurgical Bulletin,* no. 415, Nov. '46, p. 546-556.

A method of analysis of thickening tests on finely divided pulps has been developed, with which the required thickener area can be determined in one calculation. The necessary minimum depth of the thickening tank can also be calculated, using an assumed safe depth of clear solution. The degree of flocculation of pulp can be determined from a thickening test, and expressed as the flocculating diameter, or the particle diameter which marks the limit of flocculations.

1-75. Copper Losses in Smelter Slags. A. G. Scobie. *Canadian Mining and Metallurgical Bulletin,* no. 415, Nov. '46, p. 557-573.

During concentration of ore from the Flin Flon mine of the Hudson Bay Mining and Smelting Co., Ltd., silicates high in magnesia have a strong tendency to float and appear in the copper concentrate, where they cause great smelting difficulty. Investigation into the fundamental properties of smelter slags of various compositions, in an attempt to find a solution to the difficulty, is described. The effects of various constituents were determined and charted.

1-76. Preparation of Manganese Electrolyte From Manganese Mattes and Pure Oxides. David Schlain. *Bureau of Mines Report of Investigations* 3976, Oct. '46, 16 p.

Pyrometallurgical and hydrometallurgical processes for the production of mattes and oxides of relatively high purity from low-grade manganese ores. Present investigation deals with the use of such products for the preparation of manganese electrolyte with a view toward making available for the production of electrolytic manganese the large reserves of domestic manganese ores that are too low in grade or unsuitable chemically for direct treatment. Experimental results, which were encouraging, are described and tabulated.

1-77. Rationaliseringsstravanden Inom Svensk Jarnmalmsanrikning. (Rationalization in Swedish Iron Ore Dressing.) Sture Mortsell. *Jernkontorets Annaler,* v. 130, no. 9, '46, p. 369-460; discussion, p. 460-476.

Recent developments in Swedish iron ore dressing machinery. Results of a series of ball mill grinding tests illustrate the influence of ball size on grinding and on quality of product. Problem of locked particles of magnetite ores has led to thorough studies of the liberation properties in comminution of different ores, including elutriation analyses. Examples are given of combining concentration in jigs or shaking tables with magnetic concentration. Phosphorus content of certain ores can be considerably reduced by far-reaching concentration. Experiments were also made with leaching in acids, for elimination of pyrrhotite flotation at a very low pH has given good results. Also discusses supervision, control of operation, and planning of ore dressing plants and gives data of several Swedish plants. 59 ref.

1-78. Colorado Silver Bell's New Mill. *Mining World,* v. 8, Nov. '46, p. 39-41.

Mining and concentration operations. Lead, gold, and silver are produced in a new 150-ton flotation plant.

1-79. Den Svenska Bergshanteringens Utveckling Under de Senaste Aren. (Development of Swedish Mining During War.) Martin Wiberg. *Jernkontorets Annaler,* v. 130, no. 8, '46, p. 286-296, 297, 312.

A review of Swedish mining and metal production during the past decade. New methods of mining and metal production are described. Illustrated by a series of graphs and diagrams.

1-80. Ten Months Milling at Moulton Hill. The Solving of a Very Complex Ore. Part II. A. C. King and T. V. Lord. *Deco Trefoil,* v. 10, Oct. '46, p. 5-12.

Flotation procedures, sampling, thickening and filtration, and microscopic examination of mill products. Ore is composed of intimately associated sulphides. In treating, pyrite and sphalerite are depressed, while chalcopyrite, galena, and some of the precious metals are floated. Copper, lead, and zinc are recovered. (Concluded.)

1-81. Annealing Ore. *Iron and Steel,* v. 19, Nov. '46, p. 615-616.

Processing of annealing ore won from Florence Mines, at Egremont, Cumberland.

1-82. The Dressing of Complex Lead-Zinc Ores. F. B. Michell. *Mine & Quarry Engineering,* v. 12, Nov. '46, p. 135-144.

Selected flow sheets to illustrate modern practice.

For additional annotations indexed in other sections, see:

11-111; 23-234; 25-128; 26-77; 27-170.

2 SMELTING AND REFINING

2-153. Use of Oxygen in Furnaces May Revolutionize Steelmaking. W. A. Lloyd. *Iron Age,* v. 158, Nov. 21, '46, p. 104-105.

Future prospects for the process, in view of experimental work being conducted by several major U. S. and Canadian steel companies, the original Belgian work, and four years of tests by the Russians, 1932 to 1936.

2-154. Chemical and Electrochemical Methods in Nonferrous Metallurgy. V. V. Steuder. *Journal of Applied Chemistry* (U. S. S. R.), v. 19, no. 3, '46, p. 231-241. (In Russian)

Description of long-term research project set up in the eastern part of the U. S. S. R. for the purpose of developing new methods for production of highly critical metals. This research covered the hydroelectric metallurgy of lead and antimony, the hydrometallurgy of cobalt and vanadium, electrolytic refining of nonferrous metals, application of waste sulphuric gas in hydroelectric copper production, and the investigation of the electroconductivity of compounded technical electrolytes.

2-155. Some Factors in the Reduction of the Iron Content of Magnesium-Base Alloys. F. A. Fox, C. J. Bushrod, S. E. Mayer. *Journal of the Institute of Metals,* v. 73, Oct. '46, p. 55-82.

Investigations were carried out to establish a procedure, applicable to large-scale production, by which various magnesium alloys could, if desired, be made consistently with iron contents of the order of 0.002%. Settling experiments to determine possible mechanisms for the iron removal process are described in two sections. Section I deals with those on a small and medium laboratory scale, being primarily of exploratory and theoretical interest, and section II with those on a full-production scale, in which the results of the smaller scale investigations were applied.

2-156. Oxygen in Steelmaking. E. S. Kopecki. *Iron Age,* v. 158, Nov. 28, '46, p. 47-50.

Some of the factors leading to the development of low-cost oxygen. Experimental openhearth heats using oxygen suggest the possibility of considerable reduction in processing time.

2-157. A New Addition Agent for the Electrolytic Refining of Tin and Lead. Frank C. Mathers and Maurice M. Felger. *Electrochemical Society Preprint* 90-28, Oct. '46, 4 p.

"Hexanol-3 tails", phenol coefficient 16, found to be an excellent addition agent for the electrolytic refining of tin from a stannous sulphate-sulphuric acid electrolyte, 1.93 lb. being required per ton of tin refined. In the electrolytic refining of lead from the fluosilicate bath, 0.8 lb. is required per ton of metal refined.

2-158. Beryllium—I. *Metal Industry,* v. 69, Nov. 8, '46, p. 384, 394.

Production, and use in aluminum and magnesium alloys. Fluoride process; chloride process.

2-159. Use of Oxygen in the Openhearth. G. V. Slottman and F. G. Kerry. *Steel,* v. 119, Dec. 2, '46, p. 106-108, 149-150, 152.

Possibilities of increasing production by firing oxygen with the regular fuel during meltdown period. Large-scale applications of this new process are being made to prove its economic value. Some theoretical considerations.

2-160. Production of Low-Silicon Basic Iron Using High-Magnesia Slags. M. E. Nickel. *Steel,* v. 119, Dec. 9, '46, p. 112-114, 158.

Experimental program conducted at Chicago stack operating with slags of high magnesia content gives promise of smelting iron low in silicon and sulphur and with a high physical temperature.

2-161. Calcium Hydride. E. E. Halls. *Industrial Chemist,* v. 22, Nov. '46, p. 680-685.

Its preparation and industrial applications, especially as a reducing agent for production of high purity metals from oxides such as those of chromium, thorium, beryllium, vanadium, zirconium, molybdenum, boron. 18 ref.

2-162. The Structure and Mineralogy of Blast Furnace Slags Part I. D. G. Runner. *Pit and Quarry,* v. 39, Dec. '46, p. 73-74, 83.

Illustrated article begins description. (To be concluded.)

2-163. Vacuum Melting in Germany. George T. Motock. *Iron Age,* v. 158, Dec. 12, '46, p. 64-69.

Describes plant of Heraeus Vacuumschmelz of Hanau, Germany, the only large plant devoted exclusively to melting and pouring alloys in vacuum.

2-164. The Melting Shop of the Turkish State Iron and Steel Works, Karabuk. L. Cook. *Iron and Steel Institute Advance Copy,* 1946, 11 p.

Details of the furnaces and materials used together with descriptions

(Turn to page 12)

a powdered, completely water-soluble, cyanide-base salt with an incorporated carbon cover. Since it has a low weight per cubic foot, the daily replenishment required is only 5 to 10% of the bath weight. Rigid replenishment schedules are not necessary, but the cyanide content of the operating bath must be maintained above 15%. Little or no sludge is produced by the bath and the daily additions of fresh salt maintain the carbon cover.

Park Chemical's Neutra-Gas process (R-107) maintains the neutrality of chloride-base salt baths without fresh salt or rectifier additions; sludging is also eliminated.

Chloride-base neutral baths become oxidizing to steel surfaces as a result of contamination with oxides which are formed at the interface of the molten salt and the atmosphere. The basis of the Neutra-Gas process is the elimination of the deleterious oxides by passing a small amount of methyl chloride gas through the salt bath. The gas reacts with the oxides to produce chloride-base salts and a harmless gas which escapes into the atmosphere.

Kali Mfg. Co.'s new line of liquid carburizing baths known as "Kal-Cynine" (R-108) uses formulas that are free of barium compounds. These baths are completely water soluble, form no insolubles, and leave the work with a clean, bright, scale-free finish. A 5-min. immersion in hot water is the maximum time required to clean adhering salts from oil quenched parts. For light and medium case depths up to 0.060 in., time vs. case depth curves at various temperatures are comparable to those obtained by use of barium activated baths. These materials are supplied in several grades for specific operations, with working ranges from 1000 to 1750° F.

Houghton's original Perliton liquid carburizer and the many recent variations for such specific purposes as neutral hardening without rectification and interrupted quenching are described with full technical details in a new catalog (R-109).

Most newsworthy advance by Ajax Electric Co. during the past year has been the installation of a new and modern metallurgical service laboratory containing a battery of seven Ajax furnaces, with accompanying quench tanks, acid pickling tanks, rinse tanks and a drying oven (R-110).

The sole purpose of the new laboratory and its staff is to make it possible for metallurgists and production men concerned with heat treating to obtain a direct comparison between the metallurgical characteristics resulting from salt bath heat treating and those resulting from alternative methods. No charge is made for treating specimen work and no commercial heat treating work will be done.

An interesting feature of the laboratory is the complete elimination of old style hoods over the furnaces. Instead, fume disposal is accomplished by ducts built into the sides of the furnaces, leaving the space above the baths completely clear for the transfer of work by overhead hoist.

Gas Carburizing

In the field of gas carburizing an interesting production heat treating setup has been designed and constructed by Holcroft & Co. to meet the requirements of a large automotive plant (R-111). This installation includes a two-row continuous pusher-type gas carburizing furnace and provision for hot oil quenching, cooling, wash and draw. All processing operations are completely automatic, including discharge from the carburizing furnace, loading and unloading of the quench tank elevator, length of quench, wash and draw.

Major new features of this installation (numbered arrows on the illustration below) are as follows:

1. Unloading station for work not requiring draw.

2. Open-air tracks, providing for cooling of work between hot quench and wash.

3. Hydraulically operated outer discharge door from which work can be removed manually if desired, omitting quench, wash and draw.

4. Slot discharge doors, hydraulically operated, that permit removing single pieces from carburizing furnace for press quenching if desired.

The hot oil bath has elevator quench, propeller agitation and automatic temperature control. Loading and unloading of elevator and length of quenching time are controlled automatically.

Another automatic pusher-type continuous heat treating furnace was recently installed in Russia by Morrison Engineering Corp. (R-112). Novel feature of this unit is the equipment installed between the quench and draw furnaces.

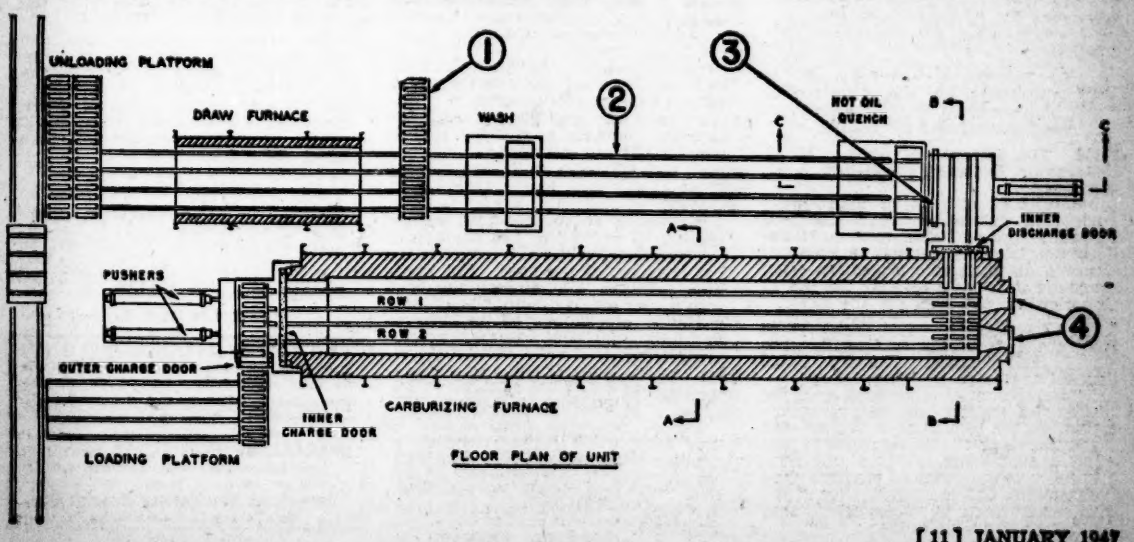
An inclined elevator from the quench tank takes the tray of work to a single-station washing machine where it is sprayed first with hot alkali and then hot rinse water. The pusher then moves the tray into the draw furnace, at the same time bringing the next tray of work from the elevator platform into the washing machine.

General Electric's new line of electrically heated, cylindrical, gas carburizing furnaces (R-113) provides maximum temperature of 1800° F. and features rapid and uniform distribution of carburizing gas throughout the charge by means of a fan placed on the furnace cover. This cover is lifted hydraulically, and guides are provided which prevent it from being lowered unless it is in proper position for sealing with the retort in the furnace.

Tanked propane or natural gas is the carburizing medium. The flow of gas is regulated by a needle valve and a visual flowmeter which are mounted on the operator's control panel, along with an automatic temperature control instrument and a strip chart recording instrument for showing the temperature of the circulating atmosphere and charge of steel.

A dual-purpose atmosphere muffle furnace that can produce the proper atmosphere for gas carburizing, yet also is applicable for general heat treating is a recent accomplishment of Surface Combustion (R-114).

After producing the basic atmosphere, the furnace utilizes a new gas enriching



of steelmaking and casting practice for the production of ingots designed for rolling in the mill without preliminary reduction in a cogging mill. Summaries of performance figures included. Brief account of controls and of methods used for training personnel.

2-165. Basic Steelmaking. K. Balajiva, A. G. Quarrell and P. Vajragupta. *Iron and Steel*, v. 19, Nov. 21, '46, p. 645-653.

Apparatus and experimental procedure used in laboratory investigation of the phosphorus reaction; analytical procedure; application of the technique to the phosphorus reaction in the basic steelmaking process; range of slag and metal compositions employed; experimental results; treatment of results; slag constitution; statistical treatment of the analytical results in the light of the probable slag constitution at high temperatures. 22 ref.

2-166. Interactions of Gases and Ore. Part VI. H. L. Saunders and H. J. Tress. *Iron and Steel*, v. 19, Nov. 21, '46, p. 714-716.

Influence of limestone on the reduction in the blast furnace of iron ore up to 850° C.

For additional annotations indexed in other sections, see:

1-75-76-79; 3-252-260; 14-333; 15-29; 16-126-127-132-134-135; 25-132; 27-172-176.

3 PROPERTIES OF METALS AND ALLOYS

3-246. Cast Nickel Alloys—Some Important Properties. Robert S. Burpo, Jr. *Materials & Methods*, v. 24, Nov. '46, p. 1223.

Table lists mechanical, thermal, magnetic and electrical properties of nickel, monel, Inconel and resistance alloy.

3-247. Molybdenum in Cast Iron. A. E. McRae Smith. *Alloy Metals Review*, v. 4, Sept. '46, p. 2-7.

Compositions, properties, applications, and production methods for the various forms of molybdenum cast iron alloys.

3-248. Outstanding Properties of Magnesium-Zirconium Alloys. (Concluded.) C. J. P. Ball. *Aluminum and Magnesium*, v. 3, Nov. '46, p. 12-13, 15, 19.

Physical properties and microstructure of these alloys made at Magnesium Elektron, Ltd., Manchester, England. Includes specifications of wrought alloys for sheets, extrusion, and high strength forging; and alloys for sand casting and die casting.

3-249. The Strength of Rivets. H. M. Henderson. *Engineer*, v. 182, Nov. 8, '46, p. 416-417.

Results of extensive experiments made to determine the strength of rivets before and after driving. Driving was found to result in marked improvement in tensile properties, often making it possible to omit the use of special analysis steel for the rivets.

3-250. The Significance of Variations in the Tensile Properties in Cast Bronzes. W. T. Pell-Walpole. *Foundry Trade Journal*, v. 80, Oct. 24, '46, p. 183-188.

Extensive series of researches on the effects of melting and casting conditions on the properties of bronzes and gun metals gives sufficient data to permit a quantitative study of the relations between tensile strength and elongation, and the significance of the wide variations in values which may occur in these materials.

3-251. Properties of "HT" Type Alloys —a Summary. Howard S. Avery. *Alloy Casting Bulletin*, Oct. '46, p. 1-9.

Research program of the Alloy Casting Institute at Battelle Memorial Institute has studied this alloy group with reference to the influence of variations in both major and minor elements on the properties of the material. This work is summarized to date.

3-252 Influence de l'Aluminium sur la Résilience de l'Acier Mi-doux d'Elaboration Electrique aux Etats Moulé et Forgé. (Influence of Aluminum on the Impact Strength of Forged or Cast Half-Hardened Electric Steel.) P. Bastien and C. Dubois. *Comptes Rendus*, v. 223, Oct. 28, '46, p. 672-674.

In experiments on acid electric steel containing 0.20% C, 0.60% Mn, 0.35% Si, 0.03% S, and 0.03% P, aluminum was added up to 0.15%. Results showed that in cast steel impact strength decreases with increasing aluminum content, while in forged steel, increased aluminum content results in increase in impact strength up to a maximum at 0.15% Al.

3-253. Anomalous High-Frequency Resistance of Ferromagnetic Metals. *Nature*, v. 158, Nov. 9, '46, p. 670-671.

Normally when a magnetic field of greater than a few gausses is applied to a ferromagnetic metal, differential permeability decreases steadily to unity. As the field is increased at wave lengths of 1 to 3 cm., there is a large increase in the product of resistivity and permeability at a certain magnetic field (shown graphically).

3-254. Reflectivity of Nickel. *Nature*, v. 158, Nov. 9, '46, p. 672.

Spectral reflectivity of nickel in the visible part of the spectrum over a range of 400° C.

3-255. Electric Steel Sheets. J. S. Vatchagandhy and G. P. Contractor. *Iron and Steel*, v. 19, Nov. '46, p. 591-597.

Composition of most commonly used transformer sheets. Watt losses measured for various steels at different annealing temperatures and soaking times. Effects of annealing time and temperatures studied and influence of finishing temperature. (To be concluded.)

3-256. Plastic Flow of Metals. J. H. Hollomon and J. D. Lubahn. *Physical Review*, v. 70, Nov. 1 and 15, '46, p. 775.

An equation has been derived connecting the four variables, strain, strain rate, temperature, and stress required for plastic flow. It has important applications to the problem of creep and to the theory of plastic flow.

3-257. Explosive Mixtures of Water and Methyl Alcohol With Magnesium and Aluminum. A. A. Shidlovsky. *Journal of Applied Chemistry* (U.S.S.R.), v. 19, no. 4, '46, p. 371-378.

Thermochemical calculations indicate possibility of the existence of a series of new explosive mixtures. Experimental investigation indicates the explosive character of H_2O-Mg, H_2O-Al and CH_3OH-Mg mixtures.

3-258. New Toolsteel Features Improved Hot Hardness. *Iron Age*, v. 158, Dec. 12, '46, p. 63.

Brittleness (from the 1.5% carbon present) is avoided by the addition of 5% vanadium, which also increases the hot hardness of the steel. Hot hardness qualities are further improved with proper cobalt content. Machining qualities; precautions to be observed in grinding and heat treatment recommendations.

3-259. Postwar Steels Offer New Design Opportunities. Robert S. Archer. *S.A.E Journal*, v. 54, Dec. '46, p. 22-25, 46.

Various properties which should be used as a guide in the selection of steel for given applications. The guiding principle in development of N.E. steel was that steels of equivalent hardenability could be used interchangeably.

3-260. Which Cast Steel? Part I. General Properties and Characteristics. E. J. Wellauer. *Machine Design*, v. 18, Dec. '46, p. 101-105, 182.

Data presented on physical properties are largely the results of production tests on acid electric, basic electric, acid openhearth, basic openhearth, and converter melted steels. Steels were melted and heat treated with foundry production equipment. Properties are shown with the "spread" which occurs, thereby reflecting the variations expected from actual production and testing variables.

3-261. Physical Properties of Steels. *Iron and Steel*, v. 19, Nov. 21, '46, p. 751-753.

Physical properties of a number of steels which enter into calculations concerning heating and cooling problems. Table gives chemical composition and initial heat treatment of each member of series of 22 steels.

3-262. Effect of Changes in Carbides on the Properties of Steel. J. B. Austin. *Metal Progress*, v. 50, Dec. '46, p. 1191-1195.

Condensation of Campbell Memorial Lecture given at A.S.M. meeting in November. Carbon content in equilibrium with austenite may be less than that corresponding to Fe_3C, the deficiency increasing with temperature. Carbon may be replaced to a limited extent by nitrogen, and iron atoms can be replaced by atoms of other carbide formers which can fit into the cementite structure. These elements tend to concentrate in the carbide phase, altering many of the properties of the steel under certain conditions.

3-263. Alloy Steels Intermediate in Chromium. Claude L. Clark. *Metal Progress*, v. 50, Dec. '46, p. 1199-1203.

Sets forth the characteristics steels must possess for satisfactory high-temperature service and indicates how these required properties vary not only in different industries but in different applications within the same industry. More common alloying elements classified. Some of them are suitable for increasing the high-temperature surface stability and others for improving the strength of alloy steel.

3-264. Hardenability of N.E.8600 H Steels. A. L. Boegehold. *Metal Progress*, v. 50, Dec. '46, p. 1220-B.

Chart gives hardness at surface, at half radius and at center, in oil and in water.

3-265. Some Effects of Zirconium on Extrusion Properties of Magnesium-Base Alloys Containing Zinc. J. P. Doan and G. Ansel. *Metals Technology*, v. 13, Dec. '46, T. P. 2107, 18 p.

Hot workability, tension and compression properties, metallography, and toughness of these alloys containing 0 to 7% Zn and 0 to 1% Zr. Zirconium has the outstanding effect of greatly increasing the extrudability of Mg-Zn alloys. Properties charted and tabulated. 14 ref.

For additional annotations indexed in other sections, see:

4-126; 5-74; 8-159; 9-142-146; 14-317; 18-261-268; 19-321; 22-574; 23-335-346-349; 25-135; 27-176.

(Turn to page 14)

CAN YOU RESISTANCE-WELD IT?
Ask for the monthly WELDING PICTORIAL for latest methods and designs for welding
Progressive Welder Co. Detroit 12, Mich.

SPECIAL BRONZES for all chemical and industrial purposes. Castings, rods, and forgings . . . *38 years' experience*
American Manganese Bronze Co.
Holmesburg, Philadelphia 36, Pa.

and recirculating system for gas carburizing. Instead of circulating all the gas in the muffle through the enriching system, thus tending to cool the entire amount, only about 10% is removed from the muffle at any time.

After filtering the atmosphere gas, the enriching gas is added through a metering orifice. The gas then passes to the recirculating pump. The gas under pressure is discharged at high velocity into a venturi within the muffle, inspirating into the venturi a large volume of muffle gases. These are mixed in the venturi and are discharged to recirculate throughout the muffle.

Conversion from a carburizing to a heat treating atmosphere and vice versa can be made without shutting down.

A significant new technique in furnace operation, according to Surface Combustion, is termed "suspended carburization". By this process the work or charge may be left in the carburizing furnace for as long as 72 hr., or over an entire weekend, without damage or change in physical characteristics.

Cyaniding and Nitriding

Homocarb gas cyaniding (Leeds & Northrup Co., R-115) has been in operation for several years but warrants mention in this review, since it has not been publicized until recent months. Cyaniding in a gas atmosphere makes it possible to obtain a file-hard case by using an oil quench rather than water or brine. Quenching distortion is reduced, less refinishing is required and there are fewer rejects.

Furnace atmosphere is a mixture of ammonia and carburizing gas. The source of cyanide is never depleted, for a fresh supply of gas flows continuously into the furnace. Spent gases burn at the furnace outlet to form a harmless residue. No ventilating hood is required. Troubles caused by carryover of cyaniding medium into the quench tank are eliminated. Accessories for cyaniding can easily be added to any Homocarb carburizing equipment, and the same equipment can be used for carburizing as well as for cyaniding.

"Dry cyaniding" is said by Perfection Tool & Metal Treating Co. (R-116) to provide a case on low-carbon carburizing steel without embrittlement or excessive distortion. A tougher core as well as a better and more uniform case is secured.

Details of the nitriding process and information about nitralloy steels are available in two good booklets by the Nitralloy Corp. (R-117). At the recent National Metal Exposition, Metlab Co. demonstrated how ordinary alloy steels, particularly S.A.E. 4140 chromium-molybdenum steel, can be commercially nitrided (R-118). S.A.E. 4140 gives a deeper and tougher case than the more costly nitralloy, but one that is not so hard. Hardness is Brinell 500 to 700—amply high—yet not so high as to cause brittleness of sharp edges. The standard nitriding process is used in this operation.

Another good technical bulletin by Armour and Co. (R-119) deals with the installation and operation of systems using anhydrous ammonia in nitriding, dry cyaniding, and as a protective atmosphere, both by itself and in conjunction with other gases.

Protective Atmospheres

Use of lithium as a protective atmosphere for heat treating has been placed in commercial operation in an installation constructed by the Lithium Co. (R-120) for the Salisbury Axle Division of the Dana Corp. This consists of a furnace for annealing steel forgings without the formation of scale.

Lithium Atmosphere Furnace

The system hinges on induction of a vaporized form of the element lithium into the furnace's heating chamber. Lithium not only prevents formation of scale during annealing, but renders the scaly crust formed in previous forging and heating of the metal harmless for subsequent machining operations. Work emerges annealed and ready for the machine shop after the one operation. The furnace, nearly 90 ft. long, incorporates new design features such as radiant tube heating and a double-row conveyer system which moves two lines of work through the heating chamber simultaneously. Only two operators are required.

General Electric's newest gas producer (R-121) provides a neutral, CO_2-free, dry, combusted gas known as Neutralene for heat treating medium and high-carbon steels without decarburization. Differing from the conventional system of using an atmosphere gas converter plus a CO_2-removal equipment, the Neutralene producer consists of a combined combustion chamber and reactivating tower, CO_2-absorbing tower, gas cooler, heat exchanger, and liquid cooler. For drying the gas, a refrigerated gas cooler and an activated alumina dryer are furnished.

Gas analysis may be varied over a relatively wide range for specific applications. A typical mixture, suitable for heat treating, sintering, and brazing, consists of about 10.5% carbon monoxide, 15% hydrogen, 1.5% methane, and 73% nitrogen (dew point, —40° F.). Another analysis of Neutralene gas, useful as an atmosphere for annealing medium and high-carbon steels and brass in bell-type furnaces, is 1 to 2% carbon monoxide, 1 to 2% hydrogen, and 96 to 98% nitrogen (dew point, —40° F.).

A gas cracking unit supplied with a catalyst to provide an atmosphere that is effective in temperatures upwards of 2450° F. is marketed by Bellevue Industrial Furnace Co. (R-122). The atmosphere generating equipment consists of a gas cracker unit with all necessary controls such as pyrometers, flowscopes, fire traps and automatic valves. A motor-driven Selas machine supplies any air-gas ratio desired into the cracking unit. Natural fuel gas at 100 B.t.u. per cu. ft. is employed, although manufactured gas can also be used.

The cracking unit consists of a retort (S.A.E. 3515) heated externally by a small furnace, operated at about 1830° F. In the retort is a quantity of high-temperature porous refractory cubes, previously impregnated with a catalyst. When 1830° has been reached, the gas and air valves are opened and the Selas machine adjusted to supply the air-gas mixture desired. The heat of the retort assures complete combustion of the mixture and the catalyst in the retort effects the reaction which produces the controlled atmosphere.

A clean, dry gas for hardening, brazing and sintering medium and high-carbon steels without carburization is provided by Lindberg's Hyen Hydryzing generator (R-123). Gas analysis is carbon dioxide, 0%; carbon monoxide, 21%; hydrogen, 40%; methane, 1%; nitrogen, 38%; oxygen, 0%. Dew point is —20° F.

The generator is fully automatic; after the pilot is lighted all phases of operation are controlled by means of push buttons. It requires no charcoal and does not have to be burned out periodically to remove soot. It operates by city or natural gas, propane or butane for both atmosphere and heating. A refractory retort permits the use of very high cracking temperatures. One generator can be used to serve several furnaces at will.

It can be used to provide an atmosphere for carbon restoration to decarburized surfaces and a carrier gas for gas carburizing as well as for hardening, brazing and sintering.

4 STRUCTURE — Metallography & Constitution

4-121. Some Thermodynamic Constants for the Solution Processes of Atoms in Metallic Solvents. Sheng-Nien Wang. *Journal of Chemical Physics*, v. 14, Nov. '46, p. 643-647.

By combining the gas-metal equilibrium data available in literature and the thermodynamic quantities of gaseous molecules and atoms from the method of statistical mechanics, thermodynamic constants for the solution processes of some atoms in some metallic solvents have been obtained. The method used is illustrated by the solution of carbon atoms in iron.

4-122. Recherche Des Causes Ayant Determiné Une Solidification a Très Gros Grains Dans un Alliage Leger. (Determination of Factors Inducing Very Coarse Grain Formation During Solidification of a Light Alloy.) *Fonderie*, no. 8, Aug-Sept. '46, p. 305-306.

Excessive coarse crystal formation in a 2A-55U alloy (containing 19% Cu, 9.79% Si, 1.13% Mg, 0.18% Mn, 0.62% Zn, 2.40% Fe, balance aluminum) has been investigated to determine the causes. They probably are excessively high magnesium and iron content, too low copper content, and possible overheating of melt above 800° C.

4-123. Optische Verschinjnselen Bij Sterk Geetste Metaalfolien. (Optical Phenomena in Strongly Etched Metal Foils.) W. G. Burgers and J. Weijdema. *Metalen*, v. 1, Sept 15, '46, p. 6-7.

Foils of rolled and recrystallized iron-nickel alloy, when etched with strong acid, show remarkable diffraction phenomena. Such phenomena are explained by the fact that peculiarly shaped holes of microscopic size are present in the etched foils. Their form depends on the crystal structure of the material.

4-124. Etude Des Glissements Plastiques Dans Les Cristaux d'Aluminium. (Study of Plastic Slip of Aluminum Crystals.) M. Charles Crussard. *Revue de Métallurgie*, v. 42, Sept. '45, p. 321-333.

Plastic slip of aluminum crystals has been investigated using various methods. Laws proposed are tentative, and further investigation seems to be necessary for their establishment. However, such laws permit application of purely mathematical methods for further research. The classical method in which metals are considered as continuous and homogeneous is avoided. An attempt is made to limit the investigation to make it a practical study.

4-125. Hypo-Eutectoid Fe-C-Mo Alloys. Fred E. Bowman. *Iron and Steel*, v. 19, Nov. '46, p. 608-612.

Results of an investigation of the partition of molybdenum in hypo-eutectoid iron-carbon-molybdenum alloys and its relation to hardenability. 10 ref. (Presented to American Society for Metals.)

4-126. Notes on the Properties of Some Ternary Magnesium Alloys Based on the Binary Alloy Containing 5% Tin. J. B. Wilson. *Magnesium Review and Abstracts*, v. 6, July '46, p. 76-88.

Microstructure and properties of a series of the above alloys containing small percentages of calcium, barium, cerium, silver, cadmium, silicon, lead, antimony, bismuth, or thorium.

4-127. A New Aluminum-Rich Phase in the Alloys of Aluminum and Manganese. K. Little, G. V. Raynor, and W. Hume-Rothery. *Journal of the Institute of Metals*, v. 73, Oct. '46, p. 83-90.

Chill castings containing a few per cent of manganese were prepared from high-purity metals, and were annealed at different temperatures. When annealed at or above 600° C., the phases obtained agreed with the usually accepted equilibrium diagram. Castings annealed at lower temperatures showed three phase structures. X-ray diffraction photographs showed the new phase to have the same structure as the "G" ternary phase in the system aluminum-chromium-manganese. This phase was unstable at high temperatures.

4-128. Is the Existence of Fine Structure Anisotropy in X-Ray Absorption Spectra of Monocrystals Possible? A. I. Kostarev. *Journal of Experimental and Theoretical Physics* (U.S.S.R.), v. 16, no. 8, '46, p. 739-743. (In Russian.)

Shows that the fine structure theory of X-ray absorption by solid bodies, based on Kronig's conceptions, leads to an assumption of anisotropy in the case of monocrystals, a fact contradicting experimental data. Theory advanced by the author denies the possibility of anisotropy and is in agreement with experimental data.

4-129. The System of Microstresses in Cold Worked Metal. Nelson M. Blachman. *Physical Review*, v. 70, Nov. 1 and 15, '46, p. 698-704.

X-ray line widths for alpha brass, which is elastically anisotropic, depend upon crystallographic direction in a systematic manner, while for tungsten, which is elastically isotropic, they do not. Variation in line width with crystallographic direction is computed for several theoretical models of internal-stress systems. The one which fits the above results best, though poorly, is that which assumes that the homogeneously strained domains suffer uniform normal stress of random magnitude.

4-130. Hydrogen in Steel. J. H. Andrew, H. Lee, A. K. Mallik, and A. G. Quarrell. *Iron and Steel*, v. 19, Nov. 21, '46, p. 665-681; discussion, p. 766-789.

Work undertaken to determine the temperature at which hydrogen can most readily be removed, and in what way this temperature depends upon the composition of the steel. Formation of hairline cracks. All experiments carried out on normal commercial steels.

4-131. Nonmetallics. J. R. Rait and H. W. Pinder. *Iron and Steel*, v. 19, Nov. 21, '46, p. 682-695; discussion, p. 765-766.

Main sources of inclusions in steel are through deoxidation, presence of sulphur and phosphorus, and such extraneous sources as trapping of slag, trapping of corroded and eroded refractories, trapping of products of reaction between steel and refractories. Various oxides which form chief inclusions discussed. Different inclusions resulting from uphill pouring and top pouring. Practical applications to steelmaking.

4-132. Martensite. Its Structure in the Tempered Condition. W. J. Wrazej. *Iron and Steel*, v. 19, Nov. 21, '46, p. 717-719.

Martensite tempered at a low temperature (100° C.) changes over into ferrite mixed with precipitated cementite in primary form.

4-133. Twin Relationships in Annealed Copper Strip. P. Coheur and C. S. Barrett. *Metals Technology*, v. 13, Dec. '46, T.P. 2104, 7 p.

Twinning of copper strip containing 0.19% iron. First-order twin relationship was found in recrystallization texture of sample cold rolled 99% and annealed from 450 to 700° C. Annealing for longer times or at higher temperatures causes an increase in twinned material. Laue photographs indicate that recrystallization is complete before these changes take place; hence they are associated with grain growth. 12 ref.

4-134. Hot Deformation Structures, Veining and Red Shortness Cracks in Iron and Steel. Axel Hultgren and B. Herrlander. *Metals Technology*, v. 13, Dec. '46, T.P. 2106, 17 p.

Specimens of low and medium-carbon, red short steel were deformed at temperatures somewhat below and above Ac_3 and the structures obtained studied microscopically. 17 ref.

4-135. Transformation of Austenite in an Aluminum-Chromium-Molybdenum Steel. R. A. Grange, W. S. Holt, and E. T. Tkac. *Metals Technology*, v. 13, Dec. '46, T.P. 2109, 13 p.

Isothermal transformation behavior of a sample from a commercial heat of nitralloy, an aluminum-chromium-molybdenum steel containing 1.25% Al, together with supplementary data including equilibrium transformation temperatures, temperature range of martensite formation, and end-quench hardenability. 13 ref.

4-136. Twinning in Polycrystalline Magnesium. C. S. Barrett and C. T. Haller, Jr. *Metals Technology*, v. 13, Dec. '46, T.P. 2103, 10 p.

An investigation of the twinning produced in polycrystalline sheet by plastic deformation as a function of direction, amount, speed, and temperature of deformation. Other variables considered were composition and temper of sheet, sheet in which twins were previously produced, and cases where twins were previously produced and the sheet was then annealed. Samples free from preferred orientations were produced on a laboratory scale by proper control of variables.

For additional annotations indexed in other sections, see:

3-256-262-265; **6**-147; **11**-102-105-113-115; **25**-132.

5 POWDER METALLURGY

5-73. Carbides in Powder Metallurgy. James R. Longwell. *Steel*, v. 119, Dec. 2, '46, p. 130, 132, 159-160, 162.

Physical properties can be controlled carefully in making parts from carbides of tungsten, titanium or other metals with metallic binders such as nickel or cobalt.

5-74. Wear Resistant and Hot-Strength Metallic Materials—Powder Metallurgy as Most Promising Method for Their Development and Production. Paul Schwarzkopf. *Powder Metallurgy Bulletin*, v. 1, Nov. '46, p. 86-91.

Use of powder metal products for wear resisting and for high temperature applications. 14 ref.

5-75. Powder Metallurgy of Nickel. G. H. S. Price. *Metal Treatment*, v. 13, Autumn '46, p. 208-212.

Comprehensive review of the literature. Effects of pressure and sintering conditions, mechanical properties, and industrial applications. 42 ref.

5-76. Effect of Particle Size on Iron Powder Properties. Part I. *Iron Age*, v. 158, Dec. 5, '46, p. 72-76.

Results of an extensive wartime research program in which two reduced-type and two electrolytic iron commercial powders were investigated as to the effects of particle size on properties of powders and powder compacts.

5-77. Fernico From Metal Powders. E. E. Burger. *General Electric Review*, v. 49, Dec. '46, p. 22-24.

Applications of alloy of iron, cobalt, and nickel. The product from conventional steel-mill technique is not too satisfactory because of variations in composition which are introduced. The sintered-powder method, which is described in some detail, is more satisfactory. Electron-tube circuit for temperature control of the furnace presented.

(Turn to page 16)

Annealing, Normalizing and Drawing Furnaces

A continuous pusher-type cycle annealing furnace has been built by Dempsey during the past year for heat treating stainless steel golf head forgings (R-124). This furnace gives completely automatic control of heating and cooling cycles as well as automatic conveying of the work through the furnace chamber.

A pusher-tray furnace for uniform heating and cooling has been designed by W. S. Rockwell Co. to heat treat large cast steel truck rear axle housings (R-125). Castings are heated to 1650° F., held at temperature for 1 hr., and then discharged on an individual tray to cool them uniformly in still air. Every 12 min., one tray containing its load enters the heating zone of the furnace and one casting is discharged.

The heating chamber is approximately 15 ft. long x 6 ft., 5 in. wide. A series of proportioning mixer burners fire from both sides, above and below the work, providing fine heat distribution. The heat input for each zone is automatically controlled by separate recording potentiometer pyrometers.

Eclipse Fuel Engineering Co. (R-126) has a recirculating air-draw furnace that is gas-fired, using an atmospheric burner with a comparatively rich primary mixture, and enough air as a secondary supply to complete combustion. These burners are fully protected against electrical and gas failures by an electronic flame-failure unit.

Electric heat is used by Edwin L. Wiegand Co. (R-127) in a furnace for tempering (at low temperature) oil-seal rings which must be held flat within 20 millionths of an inch. The furnace is approximately 5 x 6 x 6 ft. in size and is enclosed in an insulated jacket 2 in. thick. Heat is supplied through openings in the bottom of the furnace from a horizontal duct connected with a 20-kw. Chromalox air blast heater. Thus, the heated air rises over the rings and is discharged into a duct through which it is recirculated by a blower.

The furnace operates by automatic temperature control up to 500° F. It has a capacity of 250 lb. of seal rings per hr., and the drawing cycle is 4 hr. Therefore, the furnace has a constant load of 1000 lb. of rings. The rings are contained on racks which roll into and out of the furnace on a conveyer track.

Precision Units—Electrically Heated

Small electric furnaces for heat treating tool and die steels or other small parts, for high-temperature operation, or for laboratory use have been improved mainly by minor changes in design for more efficient operation, rather than by any fundamentally new principles. An exception to this might be General Electric's new laboratory box furnace for operation up to 3100° F. (R-128).

Heating units are molybdenum rods formed into sinuous loops and supported inside the heating chamber. Since the heating units must be protected against oxidation, the furnace is limited to operations which can be performed in a protective atmosphere.

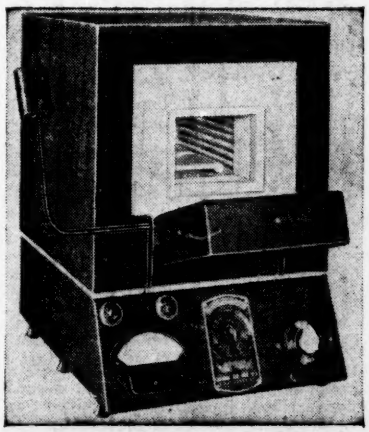
Not only does the hot muffle contain protective gas, but a water-jacketed cooling chamber also contains the protective atmosphere; to prevent transfer of heat, this prolongation is separated from the heating chamber by a manually operated sliding door. Entrance and exit doors are provided with manually operated flame curtains.

Another new electric furnace for general laboratory use and for production heat treating of small parts is Thermo Electric Mfg. Co.'s Model CEA (R-129), described in *Metals Review* for December, page 24. This furnace will maintain a temperature of 2000° F. continuously, and automatically hold any selected temperature in the range from 500 to 2000° F. Heating is fast—up to 1500° F. in 30 min.

Sentry's well-known Model "Y" high speed steel hardening furnace is now being made in a new and larger size, known as No. 5 (R-130). Muffle chamber is 7 in. high by 8⅞ in. wide by 20 in. deep. Through the use of larger sizes of Sentry diamond blocks, high speed steel tools up to 5 x 7 x 14 in. can be hardened free from scale or decarburization.

A versatile heat treating furnace in the low-cost field, utilizing temperatures up to 1850° F., is a product of the Pereny Equipment Co. (R-131). Known as Pereco Model 220-W, it is suited to the needs of the small laboratory, workshop or the amateur metal worker or school classroom, and is designed for the inexperienced operator. It can be used for hardening, annealing, drawing, carburizing, or melting; preheating of high speed steels, ceramic firing, and baking of enamels. It operates on 115 volts and draws 1500 watts.

A combination three-way heat range switch and an automatic temperature timer maintaining constant temperatures between 200 and 1800° F., with a variation of not more than 10°, feature K. H. Huppert's laboratory furnace, known as No. 5 De Luxe (R-132). Heating elements are of high-temperature alloy wire; the unit is heavily insulated, and the door is counterbalanced to close it completely. The furnace proper is separated from the base by a transite spacer, thus preventing excessive temperatures in the lower base where the instruments are located.



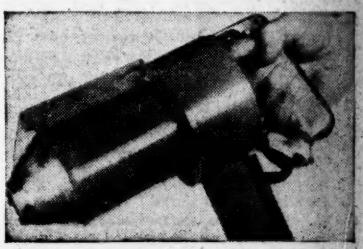
Huppert's Model 5 De Luxe

Another new Huppert model for precision treating of high speed steel reamers, cutters, and tools is recommended for continuous operating temperatures up to 2200° F., intermittently to 2250° F. It is known as the Huppert Hi-Temp (R-133).

An electric heat treater for heat treating processes to 2000° F. has been announced by the Mahr Mfg. Co. (R-134). Built in various standard overall sizes up to 54 x 102 x 88 in., the unit is used to harden carbon and alloy steels to 1850° F., temper heat treated parts, anneal, normalize or preheat high speed steels.

Induction Heating

Induction heat is still sufficiently a newcomer in the heat treating field (relatively speaking) to continue in the developmental stage, and many interesting new designs have been introduced. One of the most recent is the use of portable inductors to bring the heat to the work rather than carry the work to the heat.



Tocco Heat Gun

Ohio Crankshaft's portable unit is known as the Tocco heat gun (R-135). It is controlled by a simple trigger switch and utilizes a multiple turn coil in obtaining the necessary high flux density in the area being heated, with relatively low current supply. This permits the use of long leads of moderate dimensions to transmit power with high efficiency. The gun is built for operation with the standard 10,000-cycle motor-generator type induction heating unit.

Induction Heating Corp. compares its flexible lead and coil setup to the old-fashioned soldering iron or oxy-acetylene torch (R-136). The heating coil is mounted on a convenient grip-type handle and connected to a standard Ther-Monic output transformer by specially designed flexible leads. The heating coils can be either single or multi-turn coils, although the single-turn inductors limit the amount of power which may be transferred into the work. By use of the transformer, the terminal voltage of the coil is reduced to such a value as to minimize the danger of arc-over to the work, and any hazard to the operator.

The 30,000-cycle Tocco machine developed by Ohio Crankshaft (R-137)

5-78. Effect of Particle Size on Iron Powder Properties. Part II. *Iron Age*, v. 158, Dec. 12, '46, p. 76-80.

Need for a method of analyzing distribution of subsieve particles. (Concluded.)

For additional annotations indexed in other sections, see:

22-595; 27-182.

SWEDISH IRON POWDERS
Laboratory and Consulting Service
Ekstrand & Tholand, Inc.
441 Lexington Avenue New York 17, N. Y.

6 CORROSION

6-132. Study Copper Alloys in Sulphur, Water. Review by D. P. Thornton, Jr. From "A Study of the Corrosion of Copper Alloy Condenser Tubes", by N. W. Mitchell. *Petroleum Processing*, v. 1, Nov. '46, p. 176.

Primary causes of corrosion and results of corrosion as they are visible on the metal. Hitherto unpublished data secured from extensive corrosion tests are tabulated, which indicate comparative resistance of the various alloys to attack by sulphur and water.

6-133. "Thermogalvanic" Corrosion. N. E. Berry. *Corrosion*, v. 2, Nov. '46, p. 261-267.

Discussion is largely concerned with copper in contact with acidified cupric salt solution in absence of oxygen. Corrosion in this system occurs only when there is a substantial temperature differential, hence is called "thermogalvanic". Fundamentals of this type of cell and an apparatus for determining potential at a given temperature gradient; possibilities of this type of corrosion with other metals.

6-134. Corrosion Criteria—Their Visual Evaluation. Marc Darrin. *Corrosion*, v. 2, Nov. '46, p. 268-272; discussion p. 273-277.

Visual scoring method for evaluating panel exposure tests in aqueous media. This is necessary because of nonuniform corrosion which often makes weight loss comparisons meaningless.

6-135. Some Metallurgical Observations With Respect to Corrosion in Distillate Wells. M. E. Holmberg. *Corrosion*, v. 2, Nov. '46, p. 278-285; discussion, p. 285-286.

Localized corrosion is explained on the basis of variations in metallographic structure brought about during fabrication. Illustrated by photographs and photomicrographs.

6-136. Impedance of Meter Valves. H. Johnston. *Gas Journal*, v. 248, Oct. 30, '46, p. 727-728, 731-732.

Results of a metallographic and chemical examination of corroded gas meter valves; causes and possible methods for prevention of the corrosion.

6-137. Corrosion of Plant Equipment by Steam and Water—II. R. C. Ulmer. *Power Plant Engineering*, v. 50, Nov. '46, p. 90-92.

Factors in corrosion of steam lines, feed pumps, heaters and economizers. (To be continued.)

6-138. Special Materials Solved Corrosion Problems at Oak Ridge. R. J. Schrader and A. De Haan. *Chemical Engineering*, v. 53, Nov. '46, p. 96-100.

Specific situations are described and the suitability of various materials tried and adopted is given. Includes piping, ferrule fittings, gasket materials, high-temperature resistant materials, tanks and vessels, paints and plastic coatings, hoods and ductwork, pumps, and corrosion resistant floors.

6-139. Chemical and Heat Resistance of Gasket Materials. H. H. Dunkle and E. C. Fetter. *Chemical Engineering*, v. 53, Nov. '46, p. 102-109.

Gasket constructions in general use and gasket materials both metallic and nonmetallic; their heat and chemical resistance.

6-140. Chemical Resistance of Constructional Metals and Nonmetals. *Chemical Engineering*, v. 53, Nov. '46, p. 120-150.

Table shows resistance of materials to 24 common and troublesome chemicals. Also some of the important applications in which the materials are being used.

6-141. Some Experiences With the Protection of Bare Pipe Lines Using Zinc. F. A. Brownie. *Gas Age*, v. 98, Nov. 28, '46, p. 19-21, 27.

Costs and results, in terms of a survey of pipe potentials, for anodic protection installation of a natural gas line. Results were satisfactory except in a few instances.

6-142. Acetic Acid Vs. Materials of Chemical Plant Construction—Part I. *Chemical Engineering*, v. 53, Nov. '46, p. 253-254, 256, 258, 260, 262, 264.

Part I of a symposium in which manufacturers evaluate their products for acetic acid service. Includes carbon, graphite, Karbate; aluminum alloys; Durimet and Chlorimet; glass-lined steel; silver; tantalum.

6-143. Relative Effectiveness of Cathodic Protection and Painting in Preventing Corrosion of the Interior of Steel Tanks. T. W. Hislop, Jr. *American Railway Engineering Association Bulletin*, no. 462, Nov. '46, p. 196-201.

Progress report includes diagrams showing how cathodic protection may be applied to tanks. So far, it has given more effective corrosion prevention than paints.

6-144. The Corrosion of Metals. Part VI. The Corrosion of Copper and Its Alloys. (Continued.) *Sheet Metal Industries*, v. 23, Nov. '46, p. 2159-2164.

Problems discussed include the season cracking of brass, the dezincification of brass, corrosion-fatigue properties of copper-base alloys, resistance of copper to the atmosphere, resistance of copper alloys to sea water, galvanic corrosion in metallic couples and the behavior of copper-nickel alloys. 16 ref. (To be continued.)

6-145. Galvanic Anodes. H. A. Robinson. *Metal Industry*, v. 69, Nov. 22, '46, p. 426.

Investigations on the effects on magnesium anode performance, for cathodic protection, of such variables as current density, anode composition, impurities, electrolyte pH and electrolyte compositon. (Abstract from paper presented before the Electrochemical Society.)

6-146. Field Studies and Data on Corrosion Problems in Southeastern New Mexico. J. I. Laudermilk. *Oil and Gas Journal*, v. 45, Dec. 7, '46, p. 105-106, 108-110.

Types of corrosion and scale deposit encountered and methods used in combating them.

6-147. Stress-Corrosion of Manganese Bronze Castings in Submarine Service. Thomas L. Sheehan and Howard E. Dickerman. *Journal of the American Society of Naval Engineers*, v. 58, Nov. '46, p. 586-598.

Such castings have been used extensively for parts subject to high stress and sea water exposure. It was found that manganese bronzes having an alpha-beta microstructure were much less likely to fail because of sea water stress corrosion than those having a complete beta microstructure. Failures of beta bronzes occurred around grain boundaries while failures of alpha-beta bronzes were transcrystalline. Photographs showing microstructure of broken castings are presented. Tabulations and descriptions of test methods and results.

6-148. Methods of Determining Resistance of Nickel and Nickel Alloys to Corrosion. *Canadian Metals & Metallurgical Industries*, v. 9, Nov. '46, p. 28-32.

Laboratory methods used in corrosion estimation as outlined by Frank LaQue at the recent corrosion clinic conducted at Toronto University.

6-149. Some Case Histories of Corrosion Problems in Chemical Process Equipment. W. Z. Friend and F. L. La Que. *Transactions of American Institute of Chemical Engineers*, v. 42, Oct-Dec. '46, p. 849-860; discussion, p. 861-862.

Histories of investigation of a number of unexpected cases of corrosion of plant equipment illustrate methods of attack sometimes rquired to solve such problems. These cases include: effect of aeration on reduction of dyestuff; corrosion of nickel tubes in concentration of caustic soda; corrosion of 5% nickel steel tubes in a black liquor evaporator; effect of velocity on corrosion rate of certain oil refinery equipment; and effect of temperature on corrosion of cast iron pipe carrying SO_2.

6-150. The Corrosion of Elektron AM503 in Contact With Other Metals. C. J. Bushrod. *Magnesium Review and Abstracts*, v. 6, July '46, p. 67-73.

The corrosion of the British magnesium alloy, AM503, when coupled to stainless steel, cadmium plated mild steel, duralumin, and anodized duralumin, was investigated under conditions of atmospheric exposure and 3% salt solution exposure. Corrosion-inhibiting effect of various paints and jointing compounds on the above couples was determined.

6-151. Weathering—Appreciation and a Study. G. D. Chapman. *Light Metals*, v. 9, Nov. '46, p. 593-597, 607-608.

Significance of atmospheric corrosion of cast light alloys reviewed and illustrated by some experimental work. Possible use of X-rays to determine the type and degree of attack.

6-152. Corrosion Attack on Chimneys. J. G. de Voogd and H. J. Tadema. *Gas Times*, v. 49, Nov. 9, '46, p. 134.

Several series of tests were made to determine the effect of waste combustion gases on metals. Details of experiences with nonmetallic materials for waste gas duct construction. (Abstracted from *Brennstoff u. Warmewirtschaft*, v. 23, 1941, p. 189.)

6-153. Fundamental Factors in Corrosion Control. Herbert H. Uhlig. *Chemical and Engineering News*, v. 24, Dec. 10, '46, p. 3154-3158.

Fundamental principles of corrosion and its prevention by cathodic protection, coatings, inhibiters and passivaters, alteration of the environment, metal purification, and alloying. 29 ref.

6-154. Investigation of Oxidation of Copper by Use of Radioactive Cu Tracer. J. Bardeen, W. H. Brattain, and W. Shockley. *Journal of Chemical Physics*, v. 14, Dec. '46, p. 714-721.

A very thin layer of radioactive copper was electrolytically deposited on a copper blank. The surface was then oxidized in air at 1000° C. for 18 min., giving an oxide layer with a thickness of 1.25×10^{-3} cm. After quenching, successive layers of the oxide were removed chemically, and the copper activity in each layer was measured. Results give a fairly direct confirmation of the theory of oxidation first suggested by Wagner.

6-155. Defeat of Metal's Enemy Corrosion. A. M. Low. *Products Finishing*, v. 11, Dec. '46, p. 76, 78, 80.

Brief account of British experience in combating corrosion caused by atmosphere, sea water and sea air, and other corrosives than air and water, in connection with chemical manufacturing and process industrial equipment.

(Turn to page 18)

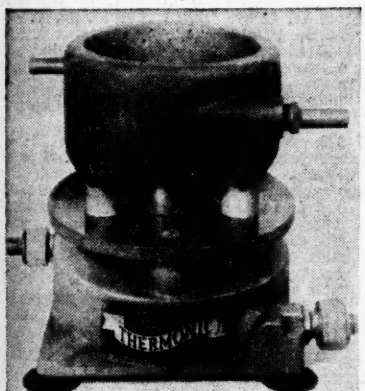
triples the previous high frequency limit of motor-generator equipment. Although the past maximum frequency of 10,000 cycles has been generally satisfactory for surface hardening parts over ⅜ in. in diameter, the new 30,000-cycle set enlarges the range of this type of equipment to include effective surface hardening of even smaller parts.

A new variable-ratio transformer has been designed to increase the adaptability of motor generator type induction heating equipment (R-138). By a simple change of leads, this transformer can be made to match any size load or any size inductor coil. Thus change-over time is negligible—one transformer is suitable for all jobs.

Also new is the 7½-kw. Toccotron unit operating at about 3 megacycles (R-139). It is designed to increase the heating efficiency on parts of very small diameter or very thin strip stock.

Induction Heating Corp. has also developed other ingenious designs for specialized applications. The Ther-Monic multi-turn split coil (R-140), for instance, greatly simplifies the induction hardening of localized surfaces of such parts as crankshafts and camshafts. Simple, single-turn split coils have been used for a considerable time, but if the diameter is relatively small, say 1 in. or less, it is necessary to use coils of more than one turn in order to transfer sufficient energy.

The new split coil consists of two or more turns, made up of machined copper plates, which are split and hinged in such a manner as to allow the coil to be opened, the work inserted in place, and the coil closed and clamped, automatically making contact between the segmental sections to provide a continuous path for current flow.



Rotary Spindle and Quench

A compact, hydraulic rotary spindle and quench ring, combined in a single unit, is another Ther-Monic accessory for heat treating parts requiring rotation during the heating cycle and subsequent quenching in position (R-141).

The workpiece is placed on a spindle, which is actuated by a water-driven turbine, fed through standard hose and nozzle attachments at the base of the unit. The speed of rotation is readily controlled by varying the flow of water.

Continuous induction heating is exemplified in an Ajax-Northrup unit designed for heating of steel slugs or forging blanks (R-142). Cold slugs are loaded into a roller-type chute on the left side of the heater, are fed in a continuous succession through the horizontal heating coil by a pneumatic ram, and drop out at the other end of the coil into a chute or tongs, ready to be placed in the forging dies.

Production rate with slugs 3⅜ in. diameter x 1¾ in. long, for instance, is 350 per hr., each slug uniformly heated to about 2200° F. Power source is a 200-kw. motor-generator set, operating at about 1000 cycles per sec. Ajax Electrothermic also has a new bulletin describing small 3 and 6-kw. spark-gap converters (R-143).

Available from Sherman Industrial Electronics Co. is an "Industrial Frequencies Chart" (R-144) showing the frequency bands commonly used for induction heating, dielectric heating, radiant heating and infrared heating. Frequency is identified with equipments such as motor-generators, arc converters, spark gap generators and electronic high-frequency generators. Formulas relating frequency to wave length in meters as well as Angstrom units are given.

Three new models of induction-type electronic power generators, of 1, 2 and 15-kw. output respectively, are now in production by RCA Victor (R-145).

These new power generators are electron tube units designed for the conversion of electrical power from the commercial 60-cycle supply to a frequency of 400,000 cycles per sec. The generators are each composed of the main generator and an applicator unit.

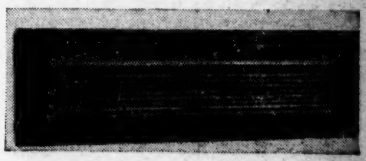
The main generator unit houses the high-voltage rectifier, the main control and protective devices, and most of the high-frequency components. The applicator unit houses the output current transformer and its associated high-frequency elements. It is connected to the main generator by 25-ft. cables, permitting the location of the applicator unit in any desired work position within this radius.

Heat Exchangers

A novel unit with some metallurgical applications is the Babcock & Wilcox pebble heat exchanger (R-146). This unit can heat gases as high as 2300° F. and has possibilities in such applications as preheating air for high combustion temperatures, or heating gases for stress relieving or other treatments.

The pebble heat exchanger consists, essentially, of an upper and a lower cylinder, both refractory lined, connected by a throat section. Both cylinders are filled with a permeable bed of spherical refractory pebbles which are moving downward in a controlled, continuous flow, being replenished at the top by means of an elevator connecting the discharge of the lower cylinder to the top of the upper cylinder. The upper cylinder is equipped with a combustion chamber so arranged that the products of combustion pass over and heat the downward moving pebbles. The gas to be heated is introduced near the bottom of the lower cylinder, picks up heat from the pebbles and is discharged at the top of the cylinder.

An electric unit for heating large quantities of air to closely controlled temperature is the Turvane, custom built by Industrial Chamberheat Laboratories (R-147). It provides a compact and uniform heat source for furnaces employing forced circulation.



Turvane Air Heater

Vanes, formed arcuate in cross section, are made from nickel-chromium alloy ribbon bent alternately on itself to form a multiplicity of narrow air passages. The unit is mounted between high-temperature refractory insulators and installed in the corner of a metal or masonry duct.

Heat is imparted most effectively to the air or gas atmosphere by the wiping action over the turning vane. At the same time, the turning vane reduces the pressure loss at the duct corner by turning thin layers of air, rather than allowing the air to crowd into the corner.

Oil Burners

Improvements in oil burners have largely taken the form of devices to break up the oil and spray it through a nozzle for better combustion. American Heat Corp.'s Arc-Heat burner (R-148) transforms the oil to a low viscosity vapor by head-on collision with air or steam in a rarefaction chamber. This is then expanded and sprayed in the firebox.

The Arc-Heat burner relies upon induced air in the firebox and draws in the air at speeds sufficient for proper combustion. It also has a modulating valve contained within itself which can restrict the amount of fire and therefore the amount of oil burned. One lever controls the modulating valve and the free air intake. Modulation can be so fine that it must be dialed by micrometer apparatus for annealing ovens and other precision equipment.

Bloom Engineering Co. has a unit oil atomizer for small gas burners or a multiplicity of small oil burners served by a preheated air system (R-149). Operating on high pressure steam, the atomizer creates a steam-oil emulsion and dissipates it to the burners. One unit supplies from three to ten burners and will operate the average forge furnace or a small boiler. The oil outlets of the atomizer project into the mixing chamber of the unit, preventing unatomized oil from entering burner lines.

In the Vapofier (Vapofier Corp., R-150) fuel oil is maintained at a constant level in the combustion chamber by a simple float valve. The products of combustion are drawn through the

6-156. The Influence of Movement on the Corrosion of Metals in Salt Solutions and Natural Waters. Part I. Low-Speed Rotation of Mild Steel: Peripheral Velocities Below 100 Ft./Min. F. Wormwell. *Iron and Steel Institute Advance Copy*, 1946, 10 p.

Using rotating-specimen technique, measurements of oxygen absorption, hydrogen evolution, loss of weight of metal, and depth of penetration of corrosion into the metal have been made with mild steel in 0.5*N* sodium chloride, "conductivity" water, a hard supply water, and sea water. Factors influencing the distribution of corrosion are discussed. 24 ref.

For additional annotations indexed in other sections, see:
7-358-386; 8-151.

7 CLEANING & FINISHING

7-353. Cleaning Engine Components. *Steel*, v. 119, Nov. 18, '46, p. 108, 139.

Automatic washing machines remove dirt from diesel engine blocks, heads and smaller parts.

7-354. A Study of Primers for Ferrous Metals in an Atmospheric Exposure. *American Paint Journal (Convention Daily)*, v. 31, Nov. 6, '46, p. 34-35.

Results of New England testing of a large number of primer formulations on cold rolled steel panels and hot rolled angle irons are presented in a table.

7-355. Infrared in Metal Finishing. Joseph M. Oxenhorn. *Organic Finishing*, v. 7, Nov. '46, p. 9-13, 16.

Theory of infrared, touching only briefly on its practical application.

7-356. Finishing Hospital Equipment. Walter Rudolph. *Organic Finishing*, v. 7, Nov. '46, p. 26-30.

Brief account of finishing room equipment and processes.

7-357. Finishing Aluminum. Part I. Rick Mansell. *Organic Finishing*, v. 7, Nov. '46, p. 31-33, 36, 41.

Precleaning by emulsion degreasing; mechanical parts washing; vapor degreasing; alkaline hot tank precleaning; surface cleaning.

7-358. The Preparation of Test Panels. George Black. *Organic Finishing*, v. 7, Nov. '46, p. 38-41.

Panels required for the variety of tests in Federal Specification TT-P-141a of four types of steel, tin, glass and wood; preparation of each.

7-359. Electrostatic Painting. Vin Zeluff. *Scientific American*, v. 175, Dec. '46, p. 252-254.

Electronic equipment which minimizes overspray waste and blisters in industrial finishing. The paint particles leaving the spray gun are drawn to the surface to be coated by an electrostatic field. Similar devices, working in reverse, remove excess paint and prevent unsightly tears.

7-360. Cleaning and Finishing Aluminum Products. Tom Winshurst. *Industrial Finishing*, v. 23, Nov. '46, p. 32-36, 38-40.

Four methods of surface preparation before painting such products as flat sheets, Eskimo Freeze shells, various deep drawn articles and new aluminum furniture.

7-361. Materials and Technique for Finishing Metal Grave Vaults. F. Hagan. *Industrial Finishing*, v. 23, Nov. '46, p. 50, 52, 56, 58, 60, 62, 64, 66.

A few of the many decorative wrinkle finishes that are especially suitable for a variety of new products made of metal.

7-362. Hot-Dip Galvanizing Practice. Part XIII. William H. Spowers, Jr. *Steel*, v. 119, Nov. 25, '46, p. 88-90, 92.

Sheet galvanizing method usually used results in relatively thin coatings which are not too satisfactory. Also, the output of "seconds" is excessive. Suggests changes in present practice to overcome these difficulties. Describes semicontinuous and continuous galvanizing lines.

7-363. Maintenance of Oil Field Equipment. D. R. Hiskey. *Corrosion*, v. 2, Nov. '46, p. 235-248.

Five requirements of satisfactory corrosion-preventing coatings for metals, with particular reference to oil field equipment.

7-364. Precision Tumbling of Metal Parts. R. M. Lord. *Materials & Methods*, v. 24, Nov. '46, p. 1227, 1229.

Gears can be deburred in a fraction of the time required with conventional methods and with a corresponding reduction in cost, using precision abrasive tumbling.

7-365. Cleaning Aluminum Before Welding With Inert-Arc Method. M. J. Conway. *Materials & Methods*, v. 24, Nov. '46, p. 1230.

Dips in sodium hydroxide and sulphuric acid produce mirror-bright, fine-contoured welds as welded.

7-366. The Technique of Fabricating "Rubber Plated" Metal. W. S. Long. *Western Metals*, v. 4, Nov. '46, p. 16-19.

Various applications of rubber lining, properties, processes, curing, adaptability, and types of linings.

7-367. Les Revetements Metalliques et la Protection Superficielle Des Pieces Moulees. (Metallic Coatings and the Surface Protection of Castings.) Marcel Ballay. *Fonderie*, no. 8, Aug-Sept. '46, p. 285-300.

Methods of surface treatment of castings such as metallic and nonmetallic coating, physico-chemical treatment (through adsorption or diffusion), chemical (oxidation, phosphating, bonderizing, etc.) and electrochemical (anodic oxidation). Descriptions of the methods and their application under different conditions are given.

7-368. Sprayed Aluminum for Corrosion Prevention. A. F. Shepard. *Aluminum and Magnesium*, v. 3, Nov. '46, p. 6-7, 9, 24.

Equipment and process for metal spraying; procedure for spraying aluminum as a protective coating on iron and steel; advantage as base for paints; applications to nine general classes of work.

7-369. Etat de Surface Chimique et Passivation d'Aciers Doux et a Faibles Teneurs en Additions. (Chemical State of Surfaces and the Passivation of Mild Steels and Steels of Low Alloy Content.) E. Herzog. *Metaux Corrosion-Usure*, v. 20, Oct. '45, p. 127-134.

A new method of surface treatment of mild steels and steels with low alloy content inducing the passivity of such surfaces and thus increasing their corrosion resistance is proposed. This method consists of preliminary dipping in nitric acid followed by dichromate treatment for 10 to 15 min. at 100° C. Passivity disappears when the surface is heated above 60° C.

7-370. Electropolishing—What Is Its Status Today. Charles L. Faust. *Journal Electrodepositors' Technical Society* v. 21, '46, p. 181-194. (Reprint.)

History of electropolishing; patent situation. Pertinent patents are shown in table listing types of solutions covered. Practical aspects of electropolishing; metals electropolished; electropolishing baths; costs, methods, and future of electropolishing. 20 ref.

7-371. Anodic Treatment of Aluminum. *Aluminium and the Non-Ferrous Review*, v. 2, July-Sept. '46, p. 58, 60-62.

Reviews German and Japanese processes for anodic oxidation of aluminum, then describes briefly English development work on the process, including superposition of a.c. on d.c. for better quality films, production of waterproof films, and utilization of the film porosity for certain applications. Commercial practice, covering pretreatment and electrical equipment in this installment. (To be continued.)

7-372. Phosphate-Coated Car Bodies. *Machinery (London)*, v. 69, Oct. 31, '46, p. 545-549.

Phosphate coating line for Mercury bodies where one goes through line every 2 min.

7-373. De-Enameling. G. H. Spencer-Strong. *Steel Processing*, v. 32, Nov. '46, p. 718-723.

Various chemical and mechanical methods; advantages of sandblasting process.

7-374. Hot Dip Galvanizing Practice. (Concluded.) Part XIV. William H. Spowers, Jr. *Steel*, v. 119, Dec. 2, '46, p. 123, 126, 129.

Equipment, materials and techniques involved when galvanizing such articles as pails, tubs, garbage cans, ash cans, funnels, oil cans.

7-375. High-Temperature Ceramic Coatings. D. G. Bennett. *Finish*, v. 3, Dec. '46, p. 13-17, 50.

Heat resistant ceramic coatings can be used to protect metals from the effects of high temperatures for long periods of time; mild steel can be used at considerably increased temperatures when proper ceramic coatings are applied; a new conception of firing technique is involved; and test methods must include all of the unusual conditions to which high temperature coatings would be subjected in actual service. Illustrations of specimen preparation and test results.

7-376. Production and Enameling Problems With Nonenameling Iron. D. S. Beal. *Finish*, v. 3, Dec. '46, p. 18, 50, 52.

Problems involved when using steel sheets; some precautions to be observed.

7-377. Automatic Cleaning and Pickling Prior to Porcelain Enameling. Leroy Camel. *Finish*, v. 3, Dec. '46, p. 19-21, 48.

Manual and automatic equipment, materials, and processes.

7-378. Modern Finishing of Light Metals. Allen G. Gray. *Light Metal Age*, v. 4, Nov. '46, p. 20-21, 23.

Recommendations for preparation of aluminum and magnesium for painting; precleaning with solvent emulsions may prove useful; colored anodic coatings on aluminum.

7-379. New Metalizing Technique "Homogenizes" Alloy Coatings to Eliminate Porosity. J. A. Looney. *Petroleum Processing*, v. 1, Dec. '46, p. 290, 292, 294.

Area to be coated is machined to the desired depth as in conventional practice, but is left as smooth as possible rather than threaded or knurled. Next, the surface is pitted by means of multiple electric arcs until the area contains thousands of tiny depressions. After this preparation, metal spraying must be done immediately. Flaming the coating until all porosity is eliminated closely follows spraying.

7-380. Metal Coated Plastics. *Modern Plastics*, v. 24, Dec. '46, p. 106-108.

Numerous applications, several of which take advantage of the electrical conductivity of metal and the insulating properties of the plastics. Newest application is a radio chassis in which the metal connections are sprayed on the plastic housing in one operation. The sprayed metal forms strips about 1/10 in. wide and 1/5000 in. thick, eliminating the need of a soldering iron in radio assembly.

7-381. New Surface Treatment for Aluminum. J. Anthony. *Iron Age*, v. 158, Dec. 5, '46, p. 64-67.

New chemical rustproofing treatment called Alodizing is said to provide a uniform and highly integrated coat-

(Turn to page 20)

surface of the oil in the combustion chamber, heating the oil to vaporizing temperature. The vapor thus created is drawn off through the premixer where proper fuel-air ratio is established and maintained. The combustible mixture is then piped to the burners.

Fuel-air ratio may be predetermined and maintained throughout the entire range of capacity. Flame quality may be varied from oxidizing to reducing.

A simple, efficient automatic control for the standard Johnston reverse-blast burner is featured by Johnston Mfg. Co. (R-151), consisting of a Fueltrol Valve attached and properly synchronized so that the air and oil balance is maintained in the same ratio at any setting between low and high fire by one lever control. The burner valves are set and adjusted to produce the desired flame at low and high setting and locked in this position. From this time on the amounts of air and oil are automatically held in constant proportions through the whole range.

Gas Burners

A new gas burner (North American Mfg. Co., R-152) affords factory presetting of the air-gas ratio. The factory is informed of the gravity and unit thermal content of the gas to be used, and in the event of a subsequent change of gas, it is only necessary to remove the adjustment cover plate and move the indicator vane to the dial position marked for the B.t.u. value of the new gas. Similarly, other air-gas ratios may be had by changing the indicator vane position to definite dial locations, readily obtained from the simplified table and instructions on the reverse side of the cover plate.

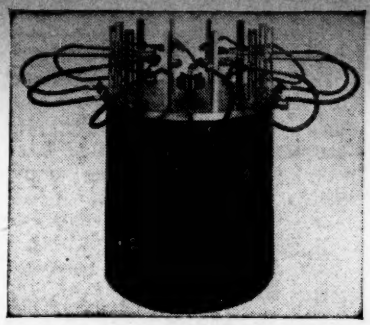
Bellevue Industrial Furnace Co. (R-153) mounts an atmospheric type burner on the lower end of the duct for recirculating the air in a furnace for heat treating aluminum alloys. Temperature is held with little or no variation, and mounting the burner in the duct eliminates the necessity of an extra heating unit.

A "Midget" heat treater has been designed by Gas Appliance Service, Inc., for experimental and development work as well as small-scale production on flame hardening, annealing, brazing or soldering (R-154). Twelve adjustable burner arms, each equipped with a valve, are mounted on a rotating table. Various types of burners are available to handle different operations.

The Midget heat treater can be used with any manufactured, mixed or natural gas (including propane or butane). Gas consumption depends on the number of burners used and the application.

Miscellaneous Equipment

Lowered temperature limits are being provided in the new units built by the manufacturers of cold treating equipment, Bowser (R-155) claiming —150° F. Super-Treat, Inc. (R-156) makes a Flash Freeze unit that can be cooled from room temperature to —130° F. in 2 hr. Dry ice is the coolant and no intricate mechanism is required.



Midget Heat Treater

Designed for holding and quenching heated gears and other parts without distortion, a new quenching press has been produced by the Gleason Works (R-157). It is equipped with a built-in pumping system and oil reservoir which reduces the external oil supply required to approximately 35 gal. per min., while providing an oil flow through the quenching die up to 225 gal. per min.

The part is clamped against distortion on a fixed lower die before the quench, and quenching consists of forcing the oil uniformly over and around the part. A sliding lower die mechanism which automatically swings out from under the upper die enables safe, quick and easy changing of the work and dies. The press is designed for oil quenching only and is air-operated.

Two new pieces of equipment useful to heat treaters have been developed by Link-Belt Co. A bucket elevator particularly suited to the handling of small and delicate parts (R-158) is unusual in that the buckets are open only in the back. This permits "internal loading" at foot from a chute extending directly through the broad side of the steel casing which encloses the elevator.

The elevating medium consists of an endless series of overlapping, inwardly opening continuous buckets supported on the pins of a wide, power-operated strand of "SS" type steel roller chain which is operated slowly over sprocket wheels at top of lift, and at foot is guided by curved steel angle tracks. There are no foot sprocket wheels. A typical installation is for lifting metallic pieces out of an oil quenching tank. The elevator buckets are perforated to permit draining oil back into tank.

The second item, the Link-Belt Electrofluid drive, available in horsepowers up to 20 (R-159), is a compact, motorized hydraulic combination consisting of a general-purpose a.c. induction motor flange-mounted on a sturdy housing containing a hydraulic coupling. Its output shaft may be direct-connected to the driven machine or to a speed reducer unit. It may also be connected to driven machine through the medium of chain, gear or belt drives.

While not new equipment, mention should be made of the Ryerson Certified Alloy Steel Plan, since it was developed to help users secure more uniform heat treatment response from alloy steel purchased from warehouse stock (R-160). It was originally built around the idea of controlling the quality of Ryerson alloys by purchasing whole mill heats that fall within narrow specification limits. Recently hardenability information has been added to the data furnished with every lot of alloy steel sold.

Ryerson subjects samples of each alloy heat to end-quench hardenability tests, and a report is prepared showing the physical properties obtainable for various size bars in the quenched and drawn condition.

In addition to showing the physicals that can be obtained, the report identifies the steel by A.I.S.I. type number, heat symbol and color marking, and gives the heat analysis and grain size.

A "Manual for Heat Treating Services" (R-161) compiled by the Metal Treating Institute is designed to illustrate the facilities available from commercial heat treaters. Written to acquaint the nontechnical manufacturer with the basic fundamentals of heat treating, this book contains sections dealing with steel selection, peacetime N.E. steels, machinability, grinding, relationship between heat treatment and design, basic principles of heat treating, a general description of the various heat treatments. Inspection and testing, how to order heat treating, and a glossary of metallurgical terms are included.

Addresses of Equipment Manufacturers

Ajax Electric Co. (R-110)
Frankford Ave. at Delaware Ave., Philadelphia 23, Pa.

Ajax Electrothermic Corp.
Trenton 5, N. J. (R-142, R-143)

American Heat Corp. (R-148)
Lowell, Mass.

Armour Ammonia Works (R-119)
1355 W. 31st St., Chicago 9, Ill.

Babcock & Wilcox Co. (R-146)
85 Liberty St., New York 6, N. Y.

Bellevue Industrial Furnace Co.
2917 Bellevue, (R-122, R-153)
Detroit 7, Mich.

Bloom Engineering Co. (R-149)
857 W. North St., Pittsburgh, Pa.

Bowser, Inc. (R-155)
Refrigeration Division,
Terryville, Conn.

Dempsey Industrial Furnace Corp.
(R-103, R-104, R-124)
Mill River Lane, Springfield 1, Mass.

Eclipse Fuel Engineering Co. (R-126)
778 S. Main St., Rockford, Ill.

Gas Appliance Service, Inc. (R-154)
1211 Webster Ave., Chicago 14, Ill.

General Electric Co.
(R-113, R-121, R-128)
Apparatus Dept., Schenectady, N. Y.

Gleason Works (R-157)
1000 University Ave.,
Rochester 3, N. Y.

Holcroft & Co. (R-111)
6545 Epworth Blvd., Detroit 10, Mich.

A. F. Holden Co. (R-101, R-102)
New Haven 8, Conn.

E. F. Houghton & Co. (R-109)
303 West Lehigh Ave.,
Philadelphia 33, Pa.

(Continued on Page 45)

ing at low cost and with comparatively short immersion time. Equipment and procedure for applying the coating.

7-382. Problems in Porcelain Enameling Nonenameling Sheets. W. A. Deringer. *Ceramic Industry*, v. 47, Dec. '46, p. 73, 76, 78.

Warpage of the ware; primary boiling; defects caused by deoxidized scale; steel blisters; pickling difficulties; copperheads; fish scaling; blistering; fabricating difficulties. (To be continued.)

7-383. Manufacturing Abrasive Buffing and Polishing Wheels. John E. Hyler. *Steel*, v. 119, Dec. 9, '46, p. 86-87, 142, 144.

Some of the techniques employed in preparing abrasives and setting up polishing wheels. (To be continued.)

7-384. Anodized Domestic Ware. Max Schenk. *Light Metals*, v. 9, Nov. '46, p. 575-592.

Potentialities of anodic treatment in relationship to possible and desirable improvements in domestic utensils in light metal. Advantages and disadvantages, and the need for systematic introductions of such processed ware.

7-385. Protective Coating Compositions for Wire. C. C. Downie. *Paint Manufacture*, v. 16, Nov. '46, p. 388-390.

Characteristics of these materials and methods used in application.

7-386. Marine Corrosion and Fouling. Part II. H. W. Rudd. *Paint Manufacture*, v. 16, Nov. '46, p. 391-397.

Corrosion of ship hulls; effects of antifouling paints; types of anticorrosive compositions; anticorrosive pigments; paints for hot and cold application (including typical compositions); the various antifouling compounds. 17 ref. (To be continued.)

7-387. Plastic Coating Inside Surface of Drill Pipe to Combat Corrosion Fatigue Failures. L. E. Trishman. *Petroleum Engineer*, v. 18, Nov. '46, p. 194, 196, 198, 200.

Requirements for a satisfactory coating, and tests of many materials which resulted in selection of an air-drying and a thermosetting phenolic coating for experimental pipe string testing. Corrosion fatigue tests were carried out on these coatings using a rotating-beam machine.

7-388. Aviation. *Russian Technical Research News*, v. 1, no. 4, '46, p. 1.

Corrosion of valve heads is one of the major problems involved in increasing degree of supercharging and compression in airplane motors. Coating entire valve head with a special alloy is recommended, containing 30% Cr, 65% Ni, small percentage of Si, Al, and Fe, and also minor amounts of Ca, Ce, and Th.

7-389. Phosphate Coating of Aluminum. R. C. Gibson and W. S. Russell. *Industrial and Engineering Chemistry (Industrial Edition)*, v. 38, Dec. 7, '46, p. 1222-1227.

Process for producing a paint-holding phosphate coating on aluminum or its alloys from a solution containing zinc phosphate, nitrate and fluoborate. Applicable to zinc and steel, and their alloys. The coating is applied by spraying or immersion. Outdoor exposure, accelerated salt spray, humidity, and soak tests show good results. 11 ref.

7-390. Studebaker Corporation Finishes 1947 Passenger Cars. Bryant W. Pocock. *Products Finishing*, v. 11, Dec. '46, p. 26-28, 30, 32, 34, 36, 38, 40, 42.

Various stages of assemblies and the finishing operations involved in each. Paint testing procedures.

7-391. Aluminum Can Be Electropolished. *Products Finishing*, v. 11, Dec. '46, p. 56, 58.

The Battelle process, the Alzak process and the Brytal process. Aluminum reflecting surfaces produced by these three methods possess good corrosion and abrasion resistance, are resistant to fingermarking, and will withstand temperatures up to approximately 400° F. without crazing.

7-392. Barrel Finishing of Metal Products. Part IV. H. Leroy Beaver. *Products Finishing*, v. 11, Dec. '46, p. 64-66, 68, 70, 72, 74.

Points the way to a more effective use of soap that will give more satisfactory end results as well as provide for a saving in production costs.

7-393. Wheels and Compounds for Buffing and Polishing. John Hyler. *Steel*, v. 119, Dec. 16, '46, p. 92-93, 117.

Buffing wheels made of fabrics, felts and leathers; purposes for which they are best suited. (To be continued.)

7-394. The Influence of Cobalt and Nickel in Vitreous Enamel Ground-Coats. Gordon C. Priddey. *Foundry Trade Journal*, v. 80, Nov. 14, '46, p. 263-268, 271.

Theories which have been put forth to explain the effects of cobalt and nickel in improving adhesion. 21 ref.

7-395. Mechanical Applications of Latex-Dip Coatings. Fred W. Woerner. *Mechanical Engineering*, v. 68, Dec. '46, p. 1049-1052.

Characterstics of natural and synthetic rubber latices; porous articles; latex-dipped coatings; miscellaneous uses for latex; coating latex on metals. Special applications.

7-396. Aluminum Cleaning Procedures. Joseph S. Brady. *Iron Age*, v. 158, Dec. 19, '46, p. 76-79.

Behavior of various cleaning, oxidizing and deoxidizing materials and means of avoiding incomplete rinsing. Effect of surface preparation on welding operations. Practical procedures.

7-397. Metal Spraying. J. Barrington Stiles. *Welding*, v. 14, Nov. '46, p. 493-499.

Methods of preparation, the principles of the process, its operation, and some established applications.

7-398. Supplementary Equipment for Buffing and Polishing. Part III. John E. Hyler. *Steel*, v. 119, Dec. 23, '46, p. 62-63, 104.

Polishing wheels other than setup types, polishing lathes, and electric polishing motors. (To be continued.)

7-399. Spray Welding. *Steel*, v. 119, Dec. 23, '46, p. 74, 77.

Hard-facing process uses a powder-flame spray gun that produces a molecular or fusion bond between the sprayed, powdered alloy overlay and base metal.

For additional annotations indexed in other sections, see:

6-141-143; 11-103-107-109; 13-42; 19-306; 23-345-356-358; 27-175-177.

8 ELECTROPLATING

8-139. Chevrolet's New Setup for Plating Bumpers. *Automotive and Aviation Industries*, v. 95, Nov. 1, '46 p. 18-21.

New electroplating department recently placed in operation produces a nickel coating of 0.0015 in., resulting from a cycle of 1½ hr. duration in the nickel plating unit. Describes and illustrates complete sequence of operation from blanking and forming to final chromium plate.

8-140. Cadmium Plate and Passivated Cadmium-Plate Coatings. E. E. Halls. *Metallurgia*, v. 34, Oct. '46, p. 295-297.

Results of tests indicate a method of processing which will give satisfactory performance. Test pieces of mild steel and of brass and copper were used.

8-141. Reducing Embrittlement in Electroplating. C. T. Eakin and H. W. Lownie, Jr. *Iron Age*, v. 158, Nov. 21, '46, p. 69-72.

Procedures, substantiated by several years of production application, whereby embrittlement can be minimized during the plating operation and removed by heat treatment following plating. A nonacid method for deplating is also presented.

8-142. Immersion Heaters Speed up Plating Production. Arthur Q. Smith. *Industrial Gas*, v. 25, Nov. '46, p. 23-24, 36-37.

Illustrated article describes techniques used by Chemical Plating Co., Stratford, Conn. Gas-fired units are used.

8-143. Metal Surfacing by Hard Chromium Plating. Edwin H. Halvorsen. *Tool Engineer*, v. 17, Nov. '46, p. 35-40.

Decorative chromium plating; hard chromium plate; other methods of surfacing and other alloys in use today; chromium plated high speed steel tools; surface finish important; tests on gear shaper cutters; misconceptions of chromium surfacing.

8-144. Some Impressions of Electroplating in U. S. A. A. W. Hothersall. *Journal Electrodepositors' Technical Society*, v. 21, '46, p. 171-180. (Reprint.)

Some impressions of American developments such as specifications and bright nickel plating, and some examples in which American practice is different from British.

8-145. Electroplating on Aluminum. E. G. West. *Journal Electrodepositors' Technical Society*, v. 21, '46, p. 211-226. (Reprint.)

Problems in depositing other metals on aluminum-base materials; principles of the methods used; cleaning; surface roughening by etching; etching combined with an immersion deposit; zinc immersion process; copper immersion process; preplate anodizing; anodizing followed by direct plating; polishing; loading the work; testing.

8-146. Some New Aspects of the Protection of Steel by Tin and Tin Alloy Coatings. E. S. Hedges and W. E. Hoare. *Metal Treatment*, v. 13, Autumn '46, p. 197-205.

Present position is that two electrodeposited tin-zinc alloy coatings, containing respectively 80% and 50% of tin are available for the protection of steel. The 80:20 coating is suitable for moist or salt-spray conditions, with excellent solderability. The 50:50 coating is more suitable for conditions of prolonged immersion in water or for applications where the coating is likely to become seriously damaged. Experimental work on this coating has not yet been published and it is too early to say what its applications may be.

8-147. A Periodic Chart for Electroplaters. George Dubpernell. *Iron Age*, v. 158, Nov. 28, '46, p. 51.

Periodic chart is designed to show the relation between elements which can be electrodeposited as metals from aqueous solutions.

8-148. Brass Plating. H. E. Zentler-Gordon and E. R. Roberts. *Metal Industry*, v. 69, Nov. 8, '46, p. 392-394.

Plating on steel and cast iron parts of brass of such structure and composition that it will readily bond to rubber. Analytical methods in present-day use.

8-149. The Electrodeposition of Cobalt and Nickel From Coordination Compounds. Margaret Davis Kramer, Sherlock Swann, Jr., and John C. Bailar, Jr. *Electrochemical Society Preprint* 90-27, Oct. '46, 7 p.

Series of cobaltic ammines and one of the nickel ammines, together with a few cobaltous ammines, were studied from the point of view of their function as electroplating agents. Data suggest that the nature of the coordinating groups, as well as the stability of the complex ions, is important in determining whether good plates will be formed. Test procedure and results.

8-150. Military Applications of Electroplating in World War II. William Blum. *Electrochemical Society Preprint* 90-32, Oct. '46, 8 p.

(Turn to page 22)

Furnace Atmospheres Do Jobs of Machine; Advances in Equipment Design Shown

Reported by J. G. Worthington
Metallurgist, J. D. Adams Co.

The chief advance made in controlled furnace atmospheres is in the design of the equipment to meet the fundamental requirements of a protective atmosphere with a sense of economy, efficiency, and simplicity of operation, Norbert K. Koebel, director of research and sales, Lindberg Engineering Co., Chicago, asserted in addressing the Indianapolis Chapter on "Furnace Atmospheres".

Furnace atmospheres are now doing the job that machines were required to do not more than ten years ago, but from the point of view of theory, there is nothing really new since 1940.

The fundamental requirements of a protective atmosphere for scale-free hardening of medium and high-carbon steel totally free from decarburization are that the carbon dioxide and water vapor constituents must be either removed or reduced and controlled at very low percentages, depending upon the alloy and carbon contents of the steel to be treated. The carbon monoxide and nitrogen constituents are desirable. Hydrogen may be present if the carbon dioxide constituent is completely eliminated and the water vapor controlled within a few tenths of a percent in the furnace. Moist hydrogen is the most active decarburizing agent in furnace atmospheres.

To meet this end, most of the equipment has been designed around one of the two following methods: The first method makes use of charcoal to produce a gas low or free of carbon dioxide, low or free of water vapor, and high in carbon monoxide and nitrogen. The second method utilizes the principle of cracking a mixture of gas and air of the proper proportion over a heated catalyst to produce a gas low or free of carbon dioxide, low or free of water vapor, and high in hydrogen, carbon monoxide, and nitrogen.

The availability of an improved grade of charcoal has changed the trend in the design and also the trend in the application of charcoal gas generators. With the use of this new purified grade of charcoal, a gas generator of a simple design, easy and foolproof to operate, low in maintenance, and costing but one-fourth as much as the externally heated type of charcoal generator can now achieve the same results.

At the present time the charcoal type of generator is restricted to the smaller toolroom furnaces and is not being applied to the production heat treatment of medium and high-carbon steels as was the practice during the war for the want of a better method. The chief reason for this is the handling and storage space required for charcoal to produce large volumes of gas demanded by large furnaces.

The so-called endothermic gas cracking generator, which comes under the second method mentioned above, has been perfected to a stage within the last few years where not only the production types of medium and high-carbon steels but also all the toolsteels, except high speed, can be hardened successfully totally free from scale, decarburization or carburization. This has been brought about by the development of a precision high-temperature gas cracking generator. A cracking temperature of 2200° F.—300 to 400° higher than previously used—insures a consistent gas analysis, free of carbon dioxide and extremely low in water vapor content, without the danger of sooting up the generator or catalyst.

The gas-air ratio can be adjusted to make a leaner atmosphere to be in composition with any carbon content steel. This makes the generator ideally suited for carbon correction or, if you prefer, carbon restoration.

Another important application of this type of generator is for the copper brazing of medium and high carbon steels bright and free from decarburization, a very difficult task to perform in the past without the use of protective coatings such as copper plating. Still another application is for a carrier gas in clean gas carburizing. By enriching the endothermic gas with approximately 1.0% propane or 2.0% natural gas, gas carburizing can be accomplished without soot and at a much faster rate.

Because the generator is fully automatic and does not need adjustment once the proper ratio is set, the speaker reports that many plants are using one large gas generator as a central station to supply atmosphere to all of the heat treating furnaces. If an operator desires to cut a furnace in or out of the line, he merely opens or closes the gas valve at the furnace and does not have to worry about making ratio, pressure, or flow adjustments at the generator; this is all handled by the automatic controls on the generator. The new precision endothermic generator is the atmosphere generator of the future when one thinks in terms of production, but the small charcoal generator will always remain popular for toolroom furnaces because of the quality job that can be done on steels extremely prone to decarburization for a low initial cost in the atmosphere equipment.

Preceding Mr. Koebel's talk, an interesting coffee talk was given by Indianapolis Chapter Chairman R. W. Stahl, describing his trip through Alaska, the Yukon territory, and down the Alaskan Highway.

Speakers' Table, Indianapolis Chapter: (Left to Right): J. T. Parker, Member Executive Committee; J. G. Worthington, Secretary; R. W. Stahl, Chairman; N. K. Koebel, Director of Research and Sales, Lindberg Engineering Co., Principal Speaker; R. H. Stewart, Treasurer; and A. J. Newsom, Vice-Chairman

Deposits of chromium, nickel, copper, zinc and cadmium, lead, tin, silver, platinum group metals, and miscellaneous applications.

8-151. Tin-Zinc Coatings. *Tin and Its Uses*, v. 17, Oct. '46, p. 5, 14.

New method of preventing corrosion of steel by means of electrodeposited tin-zinc alloys. Three pages of color photographs show comparative results of corrosion tests using these coatings and others.

8-152. Defects in Plating Solutions and Their Remedies. P. Berger. *Journal of the Electrodepositors' Technical Society*, v. 21, '46, p. 195-209. (Reprint.)

Following types of solutions are dealt with: cadmium cyanide; chromium; copper (acid and cyanide); lead (fluoborate and sulphamate); nickel (Watts type and bright nickel); silver; sodium stannate and zinc cyanide. Emphasizes value of routine analysis of plating solutions as a preventive of serious troubles and resulting loss of production.

8-153. The Control and Maintenance of Electroplating Solutions. Part I. P. Berger. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2153-2157.

Examples of various solution troubles, and practical hints on overcoming them. (To be continued.)

8-154. Steel Pipe Electroplated Inside for Corrosion Resistance. S. G. Bart. *Corrosion and Material Protection*, v. 3, Oct-Dec. '46, p. 8-10.

"Lectro-Clad process" electrolytically deposits a predetermined thickness of nickel or other corrosion resistant metals on the inside surface of pipe, tubing, and fittings. Develops a smooth, ductile, pore-free deposit, fully adherent to the base metal in thicknesses of from 0.005 to 0.100 in. Development and perfection of new plating machine makes it possible to control solution composition, temperature, pH, surface speed, current density, and other variables.

8-155. Acrylics Make Good Plating Barrels. *Modern Plastics*, v. 24, Dec. '46, p. 128-129.

Details of fabrication and operation of Lucite plating barrel.

8-156. Deposition of Metal on Plastics. (Concluded.) E. A. Ollard and E. B. Smith. *Plastics*, v. 10, Nov. '46, p. 604-608.

Preliminary coating of the article; electrodeposition of the metal; polishing and finishing; plating of designs rather than complete coatings; plating for nondecorative purposes.

8-157. Production Processes. Part XVIII. Electroforming. Roger W. Bolz. *Machine Design*, v. 18, Dec. '46, p. 129-134.

History of electroforming and some of its applications.

8-158. Copper Plating for Selective Carburizing. A. O. Sayers. *Monthly Review*, v. 33, Dec. '46, p. 1271-1276, 1310.

Investigation revealed that failure of the copper plate to stop-off was caused by several factors not necessarily directly related to the plate. These factors, together with those immediately concerned with copper plating, are discussed.

8-159. The Engineering Future of Plated Bearings. Ralph A. Schaefer. *Monthly Review*, v. 33, Dec. '46, p. 1279-1283, 1315.

Fatigue strength, wear resistance and engine performance data show that plated metals and alloys usually perform similarly to equivalent cast bearing materials and that, in certain cases, their performance is superior to that of the cast materials. Metallurgical and mechanical advantages which characterize electrodeposited bearing materials known today.

8-160. The Adhesion of Electrodeposits. Part V. A. L. Ferguson. *Monthly Review*, v. 33, Dec. '46, p. 1285-1301.

Analysis and appraisal of information from literature and private communications on adhesion tests and their evaluation. Experimental work with adhesives. What is meant by "perfect" adhesion and "perfect" bond.

8-161. The Significance of Polarization in Electroplating. H. Bandes. *Metal Finishing*, v. 44, Dec. '46, p. 516-521.

Significance of polarization with respect to current efficiency, alloy deposition, structure of deposits and throwing power. Precise polarization data are required if many of the unknowns of the art of electroplating are to be understood.

8-162. Plating With Gold. H. M. Haberman. *Metal Finishing*, v. 44, Dec. '46, p. 525-528.

Four methods of plating with gold including the common processes for obtaining the various hues, such as red, green and white.

For additional annotations indexed in other sections, see:

6-145; 7-371; 10-156; 19-306.

9 PHYSICAL TESTING

9-142. Ductility of Metals and Alloys Used in Construction—II. Georges Welter. *Metallurgia*, v. 34, Oct. '46, p. 304-310.

Results of tests made on construction materials in order to establish a classification, with respect to their ductility, of light metals and alloys in comparison with other heavy structural materials. Effect of notching under axial and eccentric loads also investigated. Standard and special notched specimens were tested under axial and eccentric loads producing single tension as well as combined tension and bending stresses.

9-143. X-Ray Diffraction Study of the Effect of Residual Compression on the Fatigue of Notched Specimens. J. T. Norton, D. Rosenthal and S. B. Maloof. *Welding Journal*, v. 25, Nov. '46, p. 729s-735s.

Preloading notched specimens in tension has resulted in residual compressive stresses without appreciably cold working the metal, and noticeable improvement of fatigue performance. Use of preloading as a means of improvement of fatigue resistance of metal parts containing stress raisers is discussed with particular emphasis on spot welding. 11 ref.

9-144. The Rapid Determination of the Elastic Limit in Steels. J. R. Cornelius. *Machinery (London)*, v. 69, Nov. 7, '46, p. 590-591.

Experiments carried out with the Cornelius electronic comparator prove conclusively that the elastic limit of a steel can be definitely plotted and that proportional elongation occurs for some considerable period after. Additional equipment necessary for such a test includes tensile testing equipment which can indicate load with fair accuracy.

9-145. A New Microhardness Tester With Knoop Indenter. J. F. Richardson and H. K. Worner. *Industrial Diamond Review*, v. 6, Nov. '46, p. 348.

This instrument incorporates a mechanism for applying and controlling the magnitude of the load. Indenter and loading mechanism are contained in a cylindrical casing which screws onto one side of the dual objective holder of the microscope, while a medium-low-power objective is held in the other side. The indenter is spring loaded and load is applied by moving the microscope tube downward by means of its rack and pinion gear. Results of tests on dental materials.

9-146. Comparison of Various Structural Alloy Steels by Means of Static Notch-Bar Tensile Test. G. Sachs, L. J. Ebert, and W. F. Brown, Jr. *Metals Technology*, v. 13, Dec. '46, T.P. 2110, 17 p.

Various steels or heats of the same steel treated to yield identical properties in the conventional tensile test may exhibit widely different service performance, except for the impact test, particularly at low temperatures. Laboratory tests in general have failed to yield clearly defined criteria for such differences. Authors have applied their static notch-bar tensile test to this problem with excellent success, since large differences were revealed where none were apparent when other testing methods were used. Test results shown graphically. 11 ref.

For additional annotations indexed in other sections, see:

3-250-252; 14-319; 18-261; 19-305; 20-501; 22-569-571-575; 24-198-199-200-201; 25-132.

10 ANALYSIS

10-133. The History and Present Status of Emission Spectroscopy as Applied to Industry. John Convey. *Metallurgia*, v. 34, Oct. '46, p. 331-334.

Historical foundation of spectroscopy; recognition of characteristic spectra; development of quantitative spectrochemistry. 25 ref.

10-134. The Volumetric Determination of Cobalt. A. J. Hall and R. S. Young. *Chemistry & Industry*, no. 44, Nov. 2, '46, p. 394-395.

Two volumetric methods suitable for analysis of smelter samples. Titrations with potassium cyanide and with potassium ferricyanide, respectively.

10-135. Spectrochemische Analyse Van Metaallegeringen Met Behulp Van Emissiespectra. (Spectrochemical Analysis of Metal Alloys Using the Emission Spectrum.) R. Schmidt. *Metalen*, v. 1, Oct. 15, '46, p. 17-22.

Fundamental principles of qualitative and quantitative emission spectrographic analysis. The most convenient light sources with corresponding diagrams of the circuits are indicated.

10-136. Zur Quantitativen Bestimmung von Wolfram, Molybdan und Vanadium fur sich und neben Eisen mit 8-Oxychinolin. (Quantitative Determination of Tungsten, Molybdenum and Vanadium Alone and in the Presence of Iron Using 8-Oxyquinoline.) R. Niericker and W. D. Treadwell. *Helvetica Chimica Acta*, v. 29, no. 6, June '46, p. 1472-1483.

Tungstate, molybdate, vanadate, and ferric ion are precipitated as oximes and titrated bromometrically. Two methods for the quantitative conversion of oximes into the corresponding oxides at 480° C. are described. Also, several methods for separation and individual determination of tungstate, molybdate, vanadate, and ferric ion using the differences of solubility of oxime in 2*N* HCl are indicated.

10-137. On the Detection of Uranium by Potassium Ferrocyanide. Moritz Kohn. *Chemist Analyst*, v. 35, Sept. '46, p. 52-53.

Oxalic acid, acetates, oxalates, tartrates, and other complex-forming substances interfere in the formation of brown uranyl ferrocyanide, which has been recommended for microchemical detection of uranium and of hydroferrocyanic acid.

10-138. A Simple Polarographic Procedure for Cadmium Dust and Fumes in Air. Leslie Silverman. *Chemist Analyst*, v. 35, Sept. '36, p. 53-55.

(Turn to page 24)

Western Metal Congress Technical Program Has More Than 75 Papers Scheduled

More than 75 technical papers, lecture courses and round-table discussions will be presented during the Fifth Western Metal Congress and Exposition to be held in the San Francisco-Oakland-Golden Gate area for six days the week of March 22. Sixteen western divisions of technical societies are cooperating in the program and other activities of the Congress, while 157 exhibitors have already reserved space in the accompanying exposition.

All technical sessions, as well as the exposition, will be held in the civic auditoriums in Oakland, Calif., which include both the Auditorium Arena and the Auditorium Exhibit Hall. The technical program will open its activities on Monday, March 24, and will continue through Thursday, March 27. Members of cooperating societies will attend sessions to be addressed by nationally renowned technical speakers. Daily meetings will begin at 9:00 a.m. and continue until 5:00 p.m.

Headquarters for the American Society for Metals during the Congress will be at the Leamington Hotel, Oakland. Special hotel reservation forms may be secured by writing to the A.S.M. headquarters, 7301 Euclid Ave., Cleveland 3, Ohio. Use of these forms will assure adequate hotel accommodations.

The 16 cooperating technical societies are the American Society for Metals, sponsors of the event; American Chemical Society; American Foundrymen's Association; American Industrial Radium and X-Ray Society; American Institute of Electrical Engineers; American Institute of Mining and Metallurgical Engineers; American Petroleum Institute; American Society for Testing Materials; American Society of Tool Engineers, Inc.; American Welding Society; Mining Association of California; Northwest Electric Light and Power Association; Pacific Coast Electric Association; Purchasing Agents Association of California, Inc.; Society of Automotive Engineers; Western Oil and Gas Association.

J. E. Dorn

E. S. Hudson, manager, Western Forge and Tool Works, Oakland, is chairman of the General Committee for the Congress; F. B. Drake, president, Johnson Gear and Mfg. Co., Ltd., Berkeley, Calif., and C. D. D'Amico, metallurgist, Joseph T. Ryerson & Sons, Los Angeles, are vice-chairmen; and Harold E. Krayenbuhl, engineer, Oliver United Filters, Inc., Oakland, is secretary. Other committee chairmen are as follows:

PROGRAM COMMITTEE—John E. Dorn, University of California, Berkeley.

EXHIBIT COMMITTEE—William Fletcher, E. F. Houghton & Co., San Francisco.

SUBCOMMITTEE FOR AMERICAN FOUNDRYMEN'S ASSOCIATION — R. Vosbrink, Berkeley Pattern Works, Berkeley.

SUBCOMMITTEE FOR AMERICAN WELDING SOCIETY—E. W. Hartz, Westinghouse Electric Corp., San Francisco.

COOPERATING SOCIETIES COMMITTEE—David Reeder, Electro Metallurgical Sales Corp., San Francisco.

PUBLICITY COMMITTEE — William Butts, General Metals Corp., Oakland.

INFORMATION AND REGISTRATION COMMITTEE—George Huck, Bethlehem Steel Co., San Francisco.

ENTERTAINMENT COMMITTEE—H. P. Etter, Air Reduction Sales, San Francisco.

ATTENDANCE COMMITTEE — George Burnside, Coulter-Sibbett Steel Co., Oakland.

The partial technical program of the American Society for Metals includes the following titles and speakers. The complete program of the Congress will be carried in the February issue of *Metals Review*.

Principles of Heat Treatment of Steel, Ernest E. Thum, editor, *Metal Progress* (two lectures).

Hardenability of Steels, Walter Jominy, Chrysler Corp.

Precision Cutting Tools, A. H. d'Arcambal, Pratt and Whitney Airplane Division (two lectures).

Interpretation of Creep and Stress Rupture Data, Francis B. Foley, The Midvale Co. (two lectures).

Alloys for Ultra High Temperature Service, F. S. Badger, Haynes Stellite Co.

Physical Chemistry of Steelmaking, John Chipman, Massachusetts Institute of Technology (two lectures).

Steel Melting Practice, C. H. Herty, Jr., Bethlehem Steel Co.

Physical Metallurgy of Stainless Steels, V. N. Krivobok, International Nickel Co. (two lectures).

Stainless Steels in Aircraft, Given Brewer, consulting metallurgist.

Combating Fatigue Failures, J. O. Almen, Research Laboratories Division, General Motors Corp. (two lectures).

Physical Metallurgy of Aluminum Alloys, E. H. Dix, Jr., Aluminum Co. of America (three lectures).

Recent Developments in Magnesium Alloys, J. C. MacDonald, Dow Chemical Co.

Corrosion of Metals, R. J. McKay, International Nickel Co. (two lectures).

Protective Coatings, R. M. Burns, Bell Telephone Laboratories.

Industrial Growth of the West, F. T. Letchfield, Wells Fargo Bank and Union Trust Co.

Mechanical Testing, Arthur E. Focke, Diamond Chain and Manufacturing Co.

New Approaches in Heat Treatment, Glen Riegel, Caterpillar Tractor Co.

Correlation of Recent Data on Hardenability, A. L. Boegehold, Research Laboratories Division, General Motors Corp.

Compliments

TO R. C. TODD, G. F. AHLBRANDT and ANSON HAYES on their election as vice-presidents of the American Rolling Mill Co. Messrs. Todd and Ahlbrandt were formerly assistant vice-presidents and Dr. Hayes has been director of research since 1929.

TO MORRIS EVANS LEEDS, founder and chairman of the board of Leeds & Northrup Co. of Philadelphia, on the award of the A.S.M.E. Medal of the American Society of Mechanical Engineers, "because of his outstanding achievements in the invention and development of electrical and temperature measuring instruments, and in the field of industrial relations".

TO EDWARD U. CONDON, new director of the Bureau of Standards, on the salute given him by *Science Illustrated*. An article in the December issue sees in him a revivifying influence and compliments him on the aid he has given to struggling senators and congressmen on wartime scientific projects.

Conveyers & Manipulaters Make Salt Baths Automatic

Reported by Knox A. Powell
Research Engineer, Minneapolis-Moline Power Implement Co.

Salt baths—types, uses, furnaces and controls—were clearly delineated by A. F. Holden, president of the A. F. Holden Co., before the Northwest Chapter on Nov. 12. The talk was followed by a series of illustrative lantern slides and an interesting informal question and answer period.

Carburizing can be done with equal efficiency in properly designed gas carburizing units or in carburizing salt baths, Mr. Holden pointed out, but distortion should be less and control somewhat easier with a salt bath. The slides showed the relative ease with which conveyers and manipulaters can be applied to salt bath equipment to make an entirely automatic heat treating unit.

Life of gas-fired salt pots can be greatly improved by deepening the pot for extra heating area, thus keeping down the heat input density. Electrode life can likewise be improved by using electrodes of larger area to keep current density down.

Rapid, simple polarographic procedure which can be applied to the determination of cadmium dusts and fumes in air or in settled dusts.

10-139. Rapid Qualitative Methods for Nickel, Chromium and Molybdenum in Low-Alloy Steels. Rolland L. Mays. *Chemist Analyst*, v. 35, Sept. '46, p. 62-63.

From the standpoints of rapidity, sensitivity, and the quantity of sample required, the procedures described have been found to be eminently satisfactory for a wide range of low-alloy steels.

10-140. Behavior of Uranyl Solutions in a Mercury Reductor. Earl R. Caley and L. B. Rogers. *Journal of the American Chemical Society*, v. 68, Nov. '46, p. 2202-2204.

In solutions containing hydrochloric acid in sufficiently high concentration, uranyl ion is almost quantitatively reduced to uranous ion in the mercury reductor. By use of small correction factor this reduction may be applied to the volumetric determination of uranium. The possible interference of uranium should be taken into account when using the mercury reductor for the determination of certain other elements.

10-141. The Accurate Volumetric Determination of Zinc and Nickel Using Diphenylcarbazone as Indicator. B. S. Evans. *Analyst*, v. 71, Oct. '46, p. 455-459.

Methods for volumetric determination of zinc and of nickel by a new process, each method being available for very low quantities and for a wide range of sample weights; volumetric determination, without separation, of zinc in nickel plating baths, and detection of an excess of zinc over a given amount in nickel plating baths.

10-142. A Method for the Determination of Zinc in Copper Alloys and for the Separation of Zinc From Cadmium. B. S. Evans. *Analyst*, v. 71, Oct. '46, p. 460-464.

Method based on a study of the behavior of the double cyanide of certain metals in presence of sulphide ion has been applied to the determination of zinc in copper alloys. An improved procedure permits complete separation of zinc from cadmium in one precipitation.

10-143. Spot Tests for the Detection of Alloying Elements in Aluminum and Magnesium-Base Alloys. B. S. Evans and D. G. Higgs. *Analyst*, v. 71, Oct. '46, p. 464-474.

Procedures described for copper, magnesium, zinc, manganese, tin, iron, nickel, titanium, antimony, bismuth, lead and chromium.

10-144. The Rapid Determination of Small Quantities of Nickel With Dithizone. R. S. Young, E. H. Strickland and A. Leibowitz. *Analyst*, v. 71, Oct. '46, p. 474-476.

Rapid procedure for determination of very small quantities of nickel is applicable to a wide variety of materials. It is based on isolation of nickel with dimethygloyoxime, its extraction with chloroform, transference to dilute acid solution, and final titration in alkaline solution with a standard solution of dithizone.

10-145. The Determination of Lead in Copper, Nickel and Cobalt by Dithizone. R. S. Young and A. Leibowitz. *Analyst*, v. 71, Oct. '46, p. 477-479.

Lead, together with arsenic, antimony, and bismuth, is collected by ferric hydroxide. Iron is removed by an ether extraction. Lead and bismuth are extracted by dithizone from an alkaline cyanide medium, and these metals are transferred to a dilute acid phase by shaking with nitric acid. Bismuth is then extracted at pH 2 to 3. Finally lead is titrated with dithizone in a solution buffered at pH 8.

10-146. The Separation of Cobalt From Nickel and the Colorimetric Determination of Nickel. A. J. Hall and R. S. Young. *Analyst*, v. 71, Oct. '46, p. 479-482.

Method in which cobalt is complexed with ammonium thiocyanate and extracted by means of a mixture of amyl alcohol and ether. Provided the amount of cobalt present is not too large (0.2 g. at the most) it may be extracted quickly and the presence of excess of thiocyanate does not interfere with the nickel determination.

10-147. Solubility of Magnesium Ammonium Phosphate Hexahydrate. R. F. Uncles and G. B. L. Smith. *Industrial and Engineering Chemistry (Analytical Edition)*, v. 18, Nov. 8, '46, p. 699-702.

Determinations of the solubility of magnesium ammonium phosphate in various concentrations of aqueous and ammoniacal salt solutions likely to be encountered in analytical practice were made. It was found that, if the recommended gravimetric procedure for magnesium was used, the solubility error was negligible. 21 ref.

10-148. Determination of Chromium by Oxidation With Perchloric Acid. Sigmund Schuldiner and Frederick B. Clardy. *Industrial and Engineering Chemistry (Analytical Edition)*, v. 18, Nov. '46, p. 728-729.

Modifications of conventional procedures which have been satisfactorily used for over two years.

10-149. Interference in Thin Parallel Surfaced Transparent Plates as a Source of Error in Spectroquantitative Analysis. Joshua Stern. *Journal of the Optical Society of America*, v. 36, Nov. '46, p. 654-658.

Analyzes the errors derivable from these interference effects. Simplest and most practicable method of eliminating the errors is to avoid the use of parallel-faced plates. This can be done in the case of slit covers, without losing the protection provided, by using a lens instead of a flat plate as the cover.

10-150. Spectrographic Determination of Small Aluminum Contents in Ordinary and Special Steels. René Castro. *Metal Treatment*, v. 13, Autumn '46, p. 182-196.

Speed of the analysis is much greater than that of chemical analysis. A method of analyzing the dissolved aluminum, using hydrochloric acid solutions with a low iron content, has been proposed. Results of these tests have been compared with work so far published in technical literature. (Translation of a paper presented in Paris in January 1946 by the Group for the Advancement of Spectrographic Methods of Analysis of Metallic Products.)

10-151. Spot Testing for Aluminum. W. E. Thrun and C. R. Heidbrink. *Iron Age*, v. 158, Nov. 28, '46, p. 68-69.

Reagent recommended for semiquantitative spot testing of aluminum in steel and iron is eriochromecyanine. It is not, however, too sensitive to the presence of iron, which may be present in small amounts in the ferric state.

10-152. Electronic Metal Analyzer. S. R. Winters. *Radio News*, v. 36, Nov. '46, p. 28-29, 164-165.

Newly developed direct-reading spectrometer designed by Dow Chemical Co. makes possible analysis of a maximum of 14 different elements found in industrial alloys. Process requires only 40 sec.

10-153. The Spectrographic Determination of Trace Elements in the Cathode Layer Arc by the Variable Internal Standard Method. R. O. Scott. *Journal of the Society of Chemical Industry*, v. 65, Oct. '46, p. 291-297.

Use of iron as the variable internal standard for determination of trace elements in the cathode layer arc, when the iron varies from 2% to 100% Fe_2O_3. Two shortened methods for derivation of working curves. 24 ref.

10-154. Method for Polarographic Determination of Traces of Copper in Aluminum Alloys. I. B. Mizetzkaya. *Journal of Applied Chemistry* (U.S.S.R.), v. 19, no. 4, '46, p. 400-403. (In Russian.)

Method described permits determination of 0.01 to 0.1% Cu with relative precision of 10%, without preliminary separation of copper from the other components of the alloy.

10-155. Interaction of Columbium and Tantalum With Polyphenols. U. V. Kariakiu and P. M. Telezhnikova. *Journal of Applied Chemistry* (U.S.S.R.), v. 19, no. 4, '46, p. 435-439. (In Russian.)

Interaction of 22 different aromatic compounds with Cb, Ta and Ti, in various media and at different temperatures. Results indicate the possibility of using some of these compounds as reagents for the colorimetric determination of Cb, Ta and Ti.

10-156. Identification of Plated Coatings. George Black and Jack Sinner. *Metal Finishing*, v. 44, Dec. '46, p. 529-530.

Simplification of identification tests on various deposits is proposed. Spot test methods are recommended, thereby reducing elaborate laboratory methods. Charts summarize the techniques.

10-157. Cast Iron. J. E. Hurst. *Iron and Steel*, v. 19, Nov. 21, '46, p. 709-714.

Standardized procedure for spectrographic analysis which is capable under routine conditions of giving an accuracy of better than ±2.5% of the content of the element being determined.

For additional annotations indexed in other sections, see:

8-148; 27-173-184.

11 INSTRUMENTS
Laboratory Apparatus

11-101. Profile and Surface Analysis. Part I. *Aircraft Production*, v. 8, Nov. '46, p. 509-512.

Development of technique for combined use of mechanical and optical magnification in high-precision measurement.

11-102. Nature Printing Aluminum Alloy Forgings. *Metallurgia*, v. 34, Oct. '46, p. 335.

An improved etchant formula to show flow lines.

11-103. Testing of Furnace Atmosphere. E. E. Howe. *Better Enameling*, v. 17, Nov. '46, p. 6-7, 44.

A few of the different gases which are encountered in the firing chamber of an enameling furnace. Except in rare instances two apparatuses, the Orsat and the Dewmeter, should supply sufficient information to insure trouble-free porcelain enamelware as to the quality of the atmosphere in the furnace chamber.

11-104. Reproducing Drawings on Metal. S. H. Barmasel. *Iron Age*, v. 158, Nov. 21, '46, p. 62-64.

Quick and simple method of reproducing engineering drawings, diagrams and instruction plates on nonporous surfaces. Process, which does not employ a silver emulsion, has the added advantage of eliminating darkroom techniques. Basic procedure; several recent developments; illustrations of its application.

11-105. The Use of Punched Cards in Molecular Structure Determinations. I. Crystal Structure Calculations. II. Electron Diffraction Calculations. P. A. Shaffer, Jr., Verner Schomaker, and Linus Pauling. *Journal of Chemical Physics*, v. 14, Nov. '46, p. 648-664.

Application of punched cards and electric accounting machines to crystal structure calculations. The machines may be used to evaluate Fourier

(Turn to page 26)

Appointments to A.S.M. Standing Committees

At the meeting of the Board of Trustees of the American Society for Metals held Nov. 22, new appointments to the various national committees of the Society were announced by President Herty and confirmed by the Board. The complete personnel of the standing committees is listed below. The new appointments are shown in italics and the numerals represent the date of expiration of membership.

Rea Hahn
Constitution

Walter Crafts
Publications

J. T. Norton
Educational

J. B. Johnson
Metals Handbook

Constitution & By-Laws Committee

Rea Hahn, Rochester Products Division, Rochester, N. Y., '47, Chairman.
D. D. Beach, Atlanta Gas & Light Co., Atlanta, Ga., '48.
Richard F. Harvey, Brown & Sharpe Mfg. Co., Providence, R. I., '48.
M. D. Johnson, Purolator Products Inc., Newark, N. J., '47.
Milo Stutzman, Midwest Research Institute, Kansas City, Mo., '49.
A. E. Focke, Diamond Chain and Mfg. Co., Indianapolis, Ind., Representative of A.S.M. Board of Trustees.

Finance Committee

H. K. Work, Jones & Laughlin Steel Corp., Pittsburgh, Chairman.
L. E. Ekholm, Alan Wood Steel Co., Conshohocken, Pa., '48.
Zay Jeffries, General Electric Co., Pittsfield, Mass., '47.
N. P. Petersen, Canadian Acme Screw & Gear Ltd., Toronto, '47.
G. E. Stoll, Bendix Corp., South Bend, Ind., '47.
K. R. Van Horn, Aluminum Co. of America, Cleveland, '49.
Clyde Williams, Battelle Memorial Institute, Columbus, Ohio, '48.

Publications Committee

Walter Crafts, Union Carbide & Carbon Research Laboratories, Niagara Falls, N. Y., '47, Chairman.
Ray T. Bayless, A.S.M., Cleveland, Secretary.
R. H. Aborn, U. S. Steel Corp. Research Laboratories, Kearny, N. J., '48.
H. I. Dixon, Sterling Alloys, Inc., Woburn, Mass., '47.
A. L. Feild, Rustless Iron & Steel Division, Baltimore, Md., '48.
J. H. Hollomon, General Electric Co., Schenectady, N. Y., '49.
R. P. Koehring, Moraine Products Division, Dayton, Ohio, '47.
H. B. Osborn, Jr., Ohio Crankshaft Co., Cleveland, '48.
F. N. Rhines, Carnegie Institute of Technology, Pittsburgh, '49.
E. S. Rowland, Timken Roller Bearing Co., Canton, Ohio, '48.
G. A. Sellers, Kansas State College, Manhattan, Kan., '47.
Larry Simon, Electromotive Corp., Chicago, '49.
Gordon Sproule, McGill University, Montreal, '47.
R. L. Templin, Aluminum Co. of America, New Kensington, Pa., '47.
A. R. Troiano, University of Notre Dame, Notre Dame, Ind., '49.
H. S. Van Vleet, American Can Co., Maywood, Ill., '48.

Educational Committee

John T. Norton, Massachusetts Institute of Technology, Cambridge, Mass., '47, Chairman.
Ray T. Bayless, A.S.M., Cleveland, Secretary.
C. R. Austin, Meehanite Metal Corp., New Rochelle, N. Y., '47.
G. M. Cover, Case School of Applied Science, Cleveland, '49.
G. R. Fitterer, University of Pittsburgh, '48.
Joseph Jackson, Wm. Steel Jackson & Son, Philadelphia, '49.
H. B. Knowlton, International Harvester Co., Chicago, '49.
C. G. Stephens, Gathmann Industrial Corp., Baltimore, Md., '47.
R. D. Stout, Lehigh University, Bethlehem, Pa., '48.

Metals Handbook Committee

J. B. Johnson, Wright Field, Dayton, Ohio, '47, Chairman.
Taylor Lyman, A.S.M., Cleveland, Secretary.
Howard Avery, American Brake Shoe Co., Mahwah, N. J., '49.
R. M. Brick, University of Pennsylvania, Philadelphia, '49.
E. S. Davenport, U. S. Steel Corp., Pittsburgh, '49.
E. O. Dixon, Ladish Drop Forge Co., Cudahy, Wis., '49.
R. L. Kenyon, American Rolling Mill Co., Middletown, Ohio, '49.
H. S. Rawdon, Bethesda, Md., '47.
Howard Scott, Westinghouse Electric Corp., Pittsburgh, '49.
Gordon T. Williams, Pratt & Whitney Div., Hartford, Conn., '49.
N. E. Woldman, Crystal Engineering Laboratories, Upper Montclair, N. J., '48.
Lyall Zickrick, A.I.M.E. Representative.
J. H. Romann, A.S.M.E. Representative.
H. L. Maxwell, A.W.S. Representative.
C. W. Obert, I.A.A. Representative.

Metal Progress Advisory Committee

E. E. Thum, Editor, Metal Progress, Cleveland.
A. L. Boegehold, President, A.S.M.
Francis B. Foley, Vice-President, A.S.M.
W. H. Eisenman, Secretary, A.S.M.
Ray T. Bayless, Assistant Secretary, A.S.M.
E. H. Dix, Jr., Aluminum Co. of America, New Kensington, Pa., '48.
H. L. Edsall, Radio Corp. of America, Harrison, N. J., '47.
Zay Jeffries, General Electric Co., Pittsfield, Mass., '47.
Merrill A. Scheil, A. O. Smith Corp., Milwaukee, '49.
Cyril S. Smith, University of Chicago, '49.
Earle Smith, Republic Steel Corp., Cleveland, '48.
Jerome Strauss, Vanadium Corp. of America, New York, '49.

Metallurgical Education Advisory Committee

R. F. Mehl, Carnegie Institute of Technology, Pittsburgh, Chairman.
C. B. Carpenter, Colorado School of Mines, Golden, Colo.
E. H. Dix, Jr., Aluminum Co. of America, New Kensington, Pa.
M. A. Grossmann, Carnegie-Illinois Steel Corp., Pittsburgh.
M. A. Hunter, Rensselaer Polytechnic Institute, Troy, N. Y.
Walter Jominy, Chrysler Corp., Detroit.
E. G. Mahin, University of Notre Dame, Notre Dame, Ind.
J. T. Norton, Massachusetts Institute of Technology, Cambridge, Mass.
A. J. Phillips, American Smelting & Refining Co., Barber, N. J.
L. M. Pidgeon, University of Toronto, Toronto, Canada.
Bradley Stoughton, Lehigh University, Bethlehem, Pa.
John W. W. Sullivan, American Iron & Steel Institute, New York, N. Y.
Thomas Washburn, Inland Steel Co., East Chicago, Ind.
R. E. Zimmerman, United States Steel Corp., Pittsburgh, Pa.

series with greater accuracy, greater speed, and greater density of calculated points than is possible by the methods used heretofore. A method for punched card calculation of structure factors is also set forth, and use of the machines for reduction of observational equations to normal equations in least squares is discussed. In Part II, similar techniques are applied to determination of the structure of gas molecules from electron diffraction photographs.

11-106. An Automatic Recording Balance. Earle Thall. *Canadian Mining and Metallurgical Bulletin*, no. 415, Nov. '46, p. 663-670.

Balance suitable for continuous recording of small changes in weight over long periods of time.

11-107. A New Electrochemical Jet Method of the Determination of Thickness of the Electrolytically Deposited Metal Layer (Cr, Ni, Sn, Cu, and Cd). A. Ogarer. *Journal of Applied Chemistry* (U. S. S. R.), v. 19, no. 3, 1946, p. 311-315.

Newly developed method of electrochemical determination of thickness of electrolytically deposited metal layers.

11-108. Electron Microscopy. James Hillier. *American Ceramic Society Bulletin*, v. 25, Nov. 15, '46, p. 438-448.

Significance of the instrument as a research tool rather than technical details of its operation. 110 ref.

11-109. Een Magnetische Laagdiktemeter. (A Magnetic Thickness-Measuring Apparatus.) A. Schuringa. *Metalen*, v. 1, Sept. 15, '46, p. 10-11.

A newly developed apparatus for measuring the thickness of dielectric coatings on steel and iron (for example paint, varnish, enamel, etc.). A very rapid thickness determination may be performed even at almost inaccessible points.

11-110. The Electron Microscope. Gaston Dupouy. *Metal Treatment*, v. 13, Autumn '46, p. 153-168, 205.

Theory, construction and operation of the electron microscope; techniques devised for the preparation of the objects to be examined; some of the results so far obtained by its application to the study of metals.

11-111. Phase-Contrast Microscopy for Mineral. *Nature*, v. 158, Nov. 2, '46, p. 621.

Phase-contrast microscopy gives good results for mineralogical studies.

11-112. Measurement of Thickness of Thin Films. *Nature*, v. 158, Nov. 2, '46, p. 621.

How interference fringes formed by multiple reflection between highly reflecting surfaces can be used for determination of thickness of thin layers of gold, silica, collodion and "Formvar", which are widely used for supporting and other purposes in electron microscopy.

11-113. Composition and Diffraction Effects in X-Ray Microradiographs. R. Smoluchowski, C. M. Lucht, and J. M. Hurd. *Journal of Applied Physics*, v. 17, Nov. '46, p. 864-870.

Theory, experimental technique; advantages of the new technique over conventional photomicrographic methods for metallurgical applications.

11-114. Electronic Voltage Compensators and Current Regulators. L. A. Beck. *Electrical Manufacturing*, v. 38, Dec. '46, p. 115-118, 212, 214.

Types of controls which have been developed to provide automatic maintenance of constant root mean square current to industrial loads. Typical loads are resistance welding machines, resistance-type furnaces, and similar loads requiring constant root mean square current input.

11-115. The Determination of X-Ray Diffraction Line Widths. C. G. Shull. *Physical Review*, v. 70, Nov. 1 and 15, '46, p. 679-684.

Methods suggested for correcting X-ray diffraction line widths for geometrical effects. Experimental data are presented for two samples of finely divided NiO and MgO which show that neither the Warren nor the Jones correction method is valid for these particular specimens. A direct Fourier transform procedure is given which permits calculation of the corrected diffraction line width for all experimental cases. 11 ref.

11-116. Cylindrometer for Measuring Large Diameters. Part I and II. *American Machinist*, v. 90, Dec. 19, '46, p. 145, 147.

Describes and illustrates instrument meant for precise measurement of large pieces.

For additional annotations indexed in other sections, see:

10-138-152; 12-197; 20-523; 27-181.

12 INSPECTION AND STANDARDIZATION

12-190. On the Relation of Instrumentation to Quality Control. Leslie E. Simon. *Instruments*, v. 19, Nov. '46, p. 654-656.

Primary sources of error or variation in measurement: errors of the operator and of the instrument; variations in the product being measured. Also covers product variation, importance of instrument calibration, relation of instrument variation to product variation, and analytical separation of sources of variation. The application of these principles to the problem of acceptance testing of ammunition is detailed.

12-191. 20 Million Volt Betatron for Industrial Radiography. *Iron Age*, v. 158, Nov. 21, '46, p. 60-61. Also *Steel*, v. 119, Nov. 25, '46, p. 68-69, 92.

Features of betatron, which permit production of high quality radiographs rapidly and with low cost, are deep penetrating power, sharp focus and speed. These features are said to make this unit competitive, from an over-all viewpoint, with 1 and 2-million volt machines.

12-192. Planned Simplified Inspection. Philip G. Fishback. *Tool Engineer*, v. 17, Nov. '46, p. 30-34.

Two fundamental principles—a sound foundation and interdepartmental cooperation—determine the efficiency of the inspection department.

12-193. "Blow-Up" Photos Facilitate Research and Inspection. M. W. Seavey. *Tool Engineer*, v. 17, Nov. '46, p. 45-48.

Photographing contour projections on optical comparator assists in the control of quality.

12-194. Bestamning av Kornstoriek has Mjuka Stal. (Determination of Grain Size in Mild Steels.) B. D. Enlund and G. Schlberg. *Jernkontorets Annaler*, v. 130, no. 8, '46, p. 273-284.

Grain size chart based on actual micrographs which were traced over and reproduced in different magnifications. Conversion of the scale to A.S.T.M. scale may be made by formula.

12-195. Quality Control of Steel Gear Parts. *Tool & Die Journal*, v. 12, Nov. '46, p. 93-94, 114-B.

Case history of problem involving grinding job held to tolerances of ±0.0005 in. Questions presented were: Can quality control method provide some way by which not even one defective piece reaches the truck assembly line, and can this result be secured and one-third of inspection expense be eliminated?

12-196. Nondestructive Magnetic Inspection of Steel. R. L. Cavanagh. *Steel Processing*, v. 32, Nov. '46, p. 730-732, 737.

Operation and application of the "Ferrograph", an instrument operating on the transformer principle.

12-197. Supersonic Flaw Detector. *Electronics*, v. 19, Dec. '46, p. 198, 202, 206, 210, 212.

Method adopted by Germans for flaw detection in metals that cannot be tested by X-ray or magnetic methods. Method uses a quartz crystal as a generator, with frequency wobbled 100 cycles to avoid standing waves in the test sheet or between the transmitter and receiver. Vibrations pass through a metal block chamber. Makes contact with sheet being tested by means of rollers which maintain the gap constant at 0.5 mm.

12-198. Statistical Control Cuts Scrap Cost 88%. Clifford W. Kennedy. *Factory Management and Maintenance*, v. 104, Nov. '46, p. 102-105.

Scrap and rework pieces down 88%; direct inspection cost down 90%; hours per unit improved; production leveled out and increased.

12-199. Practical Tool Inspection and Quality Control Methods. D. P. Walsh. *Tool Engineer*, v. 17, Dec. '46, p. 29-34.

Applies magnaflux and Zyglo techniques to the inspection of perishable tools.

12-200. Tools and Statistical Quality Control. A. A. Goodman. *Tool Engineer*, v. 17, Dec. '46, p. 40-43.

Cites two examples—elimination of tool breakage and significance of variance between jigfuls and within jigfuls—to indicate the close tieup that statistical quality control can have with the tool engineer, thus leading to better methods and equipment.

12-201. Sampling Techniques Applied to Quality Control. Eugene Goddess. *Iron Age*, v. 158, Dec. 12, '46, p. 70-75, 136A.

How to make a proper sampling and select an optimum sample size from the point of view of practicality and statistical accuracy.

12-202. Location of Internal Defects by Supersonics. J. W. Dice. *Instruments*, v. 19, Dec. '46, p. 718-722.

Principle of operation of the Sperry supersonic reflectoscope. Pattern on an oscilloscope screen provides a visual indication of the location of any defects that may be present in the material.

12-203. Tapering for Surface Inspection. W. J. Darmody. *American Machinist*, v. 90, Dec. 19, '46, p. 134-135.

Taper sectioning is performed by grinding and lapping a tapered area on the surface to be analyzed. Section should be deep enough to remove all traces of the machine surface finish at the lowest point and should make only a slight angle wth the surface—between 1° and 2½°.

12-204. X-Raying Turbine Parts. J. A. Pratt. *Steel*, v. 119, Dec. 23, '46, p. 60-61, 102.

Methods used at South Philadelphia works of Westinghouse where 1000-kv. and 220-kv. X-ray machines and radium capsules are used.

For additional annotations indexed in other sections, see:

14-331; 18-269; 20-497; 22-573-590.

13 PYROMETRY Temperature Control

13-42. Temperature Control of Enameling Furnaces. A. I. Andrews. *Finish*, v. 3, Dec. '46, p. 22-23, 52, 56.

Types of thermocouples; calibration; homogeneity; welding; optical pyrometers; radiation pyrometers; melting point salts.

(Turn to page 28)

Los Angeles Industries Illustrate Superiority of Alloy Steels

Reported by H. L. Millar
Assistant Metallurgist
Plomb Tool Co.

"The Use of Alloy Steels and Their Application to Los Angeles Industries" was presented to the November meeting of the Los Angeles Chapter by James Spade, Southern California branch manager of Allegheny Ludlum Steel Corp.

"Jim", as he is familiarly known to the local members, traced the evolution of metal tools from the humblest beginning to the ultimate in engineering alloys and showed by comparison of service life records the superiority of alloy steel over carbon steel whether it be used for a garden rake or a rocket ship. Midway from the turn in the century manufacturers of hand implements and machinery in general, according to the speaker, began to feel the nudge of competition to improve the quality of their products. Compelled, as they were, to accept the challenge, manufacturers availed themselves of the superior qualities of alloy steels.

J. H. Spade

These qualities Mr. Spade enumerated as: (*a*) improved mechanical properties for greater strength or improved design, (*b*) greater abrasion resistance which permits of longer service with less wear, (*c*) greater ease and wider range of heat treatment resulting in less distortion and more production with less exertion of skill, (*d*) greater toughness for the same hardness, (*e*) better adaptability to welding without subsequent treatment, and (*f*) higher strength and hardness at high heat.

To illustrate some of these properties the speaker showed slides of Jominy hardenability charts of both carbon and alloy steels from which the most desirable properties could be correlated to composition with a fair degree of accuracy.

Mr. Spade drew specific examples from Los Angeles industries to show how improvements had been effected in hand service tools, agricultural implements, automotive forgings, springs, gears and axles, oil well machinery and transportation equipment. Modern railroads with improved locomotives and roller bearing trains require only three changes of engines on transcontinental trips as compared to changes every 200 or 300 miles with old-type equipment, he pointed out.

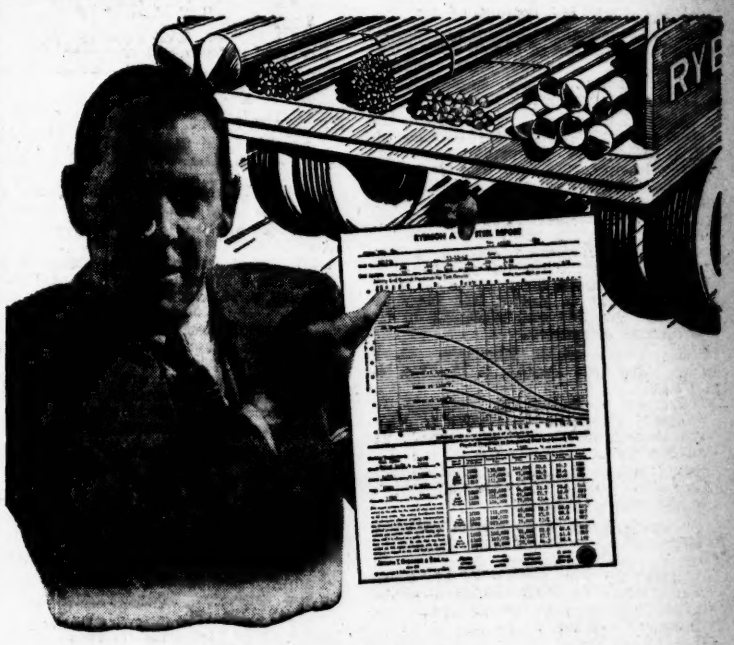
A series of slides on Army tests at White Sands, N. M., Proving Grounds, gave the audience an awesome impression of jet planes and rockets. The "Wac Corporal", a 700-lb. rocket made of low-carbon chromium-molybdenum steel and powered with a mixture of red fuming nitric acid and aniline, was pictured in the beginning of flight to an altitude of 240,000 ft., a performance which could not have been accomplished without the use of alloy steel.

Payson on TTT-Curves

Reported by W. K. Hansen
Cuyahoga Works Chemist
American Steel & Wire Co.

Peter Payson's famed TTT-curves were demonstrated and explained before the Cleveland Chapter meeting on Dec. 2. Ralph Leo, division metallurgist, American Steel & Wire Co., acting as technical chairman, introduced Mr. Payson, assistant director of research, Crucible Steel Co. of America.

By the use of the time-temperature-transformation curves he showed how to obtain the desired annealed structures for various grades of steel. His address has been reported in previous issues of *Metals Review*.



Ryerson Guide Data

with Alloy Steel from stock

High quality alloys of established heat treatment response — tons of them — are ready for delivery in every standard analysis from nearby Ryerson stocks. Your alloy steel requirements get quick, personal attention whether they call for a single bar or a car load.

With every Ryerson alloy shipment, you receive an informative report giving the exact analysis and Jominy test response. Interpreted physical properties and recommended working temperatures are also included.

The Ryerson alloy report has proved a time-saving guide for many companies. It gives purchasing men a complete record in convenient form of the particular steel received. It tells heat treaters and designers what properties can be expected and how to obtain them. There's no chance of error because the heat symbol and color marking of your alloy is entered on the report, providing a positive cross-check between steel and data.

This additional service on alloys is rushed to you at no extra cost. The report, together with a complete range of certified alloys in stock, establishes Ryerson as first source for quick shipment of alloy steel.

One of twelve Ryerson plants is convenient to you. Call, wire or write for prompt, versatile service.

Joseph T. Ryerson & Son, Inc. Steel-Service Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL

13-43. The Measurement of Gas Temperature. G. F. Hubing. *Journal of the American Society of Naval Engineers*, v. 58, Nov. '46, p. 573-585.

Factors other than pyrometer indications which must be considered in determining actual gas temperatures are evaluated. Equations derived and sample calculations presented to correct the readings taken in a duct containing gas in motion.

13-44. Measurement of Tool-Tip Temperature. *Engineering*, v. 162, Nov. 8, '46, p. 435-436.

Details of an improved method based on the principle that the tool tip and the work it is cutting constitute the two elements of a thermojunction in which the leads consist of long, continuous, ribbon turnings from the steel sample under investigation. (Abstracted from "A Method for Measuring Tool-Tip Temperature" by Bert A. Crowder. Engineering Experiment Station, University of Minnesota, Technical Paper no. 55, June 1946.)

13-45. Photographic Photometry Applied to the Measurement of Liquid Steel Temperatures. J. Ainger Hall. *Photographic Journal*, v. 86B, Sept-Oct. '46, p. 117-131; discussion, p. 131-132.

Method used was to photograph the steel stream and a series of four standard sources of temperature on the same 16-mm. film. In this way, calibration data are available on each frame of the film. Various sources of error inherent in the method are discussed, and the experiments which were made in order to arrive at suitable corrections are described. It is believed that an accuracy of $\pm 10°$ C. in the 1500° C. region has been attained. Possible improvements in the technique suggested.

13-46. Thermostatic Bimetals. C. F. Alban. *Machine Design*, v. 18, Dec. '46, p. 124-128.

Design of actuating elements for temperature responsive devices. Various thermostatic devices; correct use of bimetals.

13-47. Basic Design of Thermowells. George R. Feeley. *Machine Design*, v. 18, Dec. '46, p. 143-145.

Standardized thermowells assist in eliminating unnecessary fabrication costs and production problems involved with unorthodox and sometimes needlessly complicated designs. (Paper presented at the recent Instrument Society Conference.)

13-48. Heat Flow. R. H. Baulk and M. W. Thring. *Iron and Steel*, v. 19, Nov. 21, '46, p. 654-664.

Meter for use in furnaces and results of its use in various locations, together with illustrations and design features of furnaces.

13-49. Liquid Steel Temperatures. D. Manterfield and J. R. Thurston. *Iron and Steel*, v. 19, Nov. 21, '46, p. 695-697.

Improvement in design of immersion pyrometer. New type of arm and end block has helped to simplify the operation of temperature measurement, considerably cut down maintenance and reduced embrittlement troubles.

ELECTRONIC TEMPERATURE CONTROLS
Pyrometer-Potentiometer and Resistance Thermometer Controllers. Combustion Safeguards.
Wheelco Instruments Co. Chicago, Ill.

14 FOUNDRY PRACTICE

14-313. Sources of Hydrogen in Cast Iron. W. Y. Buchanan. *Foundry Trade Journal*, v. 80, Oct. 10, '46, p. 143-144.

Letter discusses recent paper by R. C. Tucker. In order to clarify the distribution of moisture in coke, which is said to be a major source of the hydrogen, experiments on the drying rate of coke which has been immersed in water and then heated to various temperatures were made. Results, which are tabulated and charted, indicate that moisture would be evaporated almost instantly at the temperature of the cupola gases, hence could play no part as a source of hydrogen.

14-314. Improved Sealing of Porous Castings. Oliver Pritchard. *Industrial Gas*, v. 25, Nov. '46, p. 9-11.

Use of Polyplastex resins for impregnation of porous castings.

14-315. Fabrication Des Chemises de Cylindres Moulees en Sable et Centrifugees. (Production of Cylinder Shells by Centrifugal Casting in Sand.) *Fonderie*, no. 8, Aug-Sept. '46, p. 306-307.

Method for centrifugal casting of cylinder shells. The most appropriate composition of cast steel is indicated.

14-316. Synthetic Sand in an Aluminum Foundry. William G. Parker. *Aluminum and Magnesium*, v. 3, Nov. '46, p. 16-19.

Importance of properly prepared sand specimen and need for properly mounted sand rammer.

14-317. Giettemperaturen Van Zinklegeringen. (Casting Temperature of Zinc Alloys.) J. H. F. Van Der Zanden. *Metalen*, v. 1, Oct. 15, '46, p. 29-32.

During sand casting of such alloys, heating of the molten metal above 500° C. improves considerably its castability, particularly in thin-walled and intricate sand castings. Superheating of alloys up to 650° C. does not affect their mechanical properties.

14-318. How Much Venting Power Must Green Sand Molds Possess? E. C. Troy. *Foundry*, v. 74, Dec. '46, p. 82-85, 216, 218, 220.

A compilation of investigations relating to steel casting defects and green sand properties. Data and observations reported are the results of numerous independent experiments. Conclusions advanced have been amply supported in commercial application.

14-319. Fluidity Testing of Foundry Alloys. K. L. Clark. *Foundry*, v. 74, Dec. '46, p. 92-96, 244-252.

Reviews published work and offers recommendations on fluidity testing practice used to evaluate casting characteristics of foundry alloys. (Paper presented before Institute of British Foundrymen as 1946 exchange paper from American Foundrymen's Association.) 105 ref.

14-320. The Hot Blast Cupola. Marcel Bader. *Foundry*, v. 74, Dec. '46, p. 104-106, 252-254.

Experiences of others with hot blast cupolas; results of large-scale German tests using the hot blast cupola proposed by Piwowarsky. These tests show that malleable iron can be melted more economically and that the quality of the product is improved when the hot blast is used.

14-321. Pattern Rigging for Production Molding. F. C. Riecks. *Foundry*, v. 74, Dec. '46, p. 111, 234-236.

Molding operations at Ford Motor Co. Patterns and machine to which they are attached should be considered as a team; pattern and core boxes should also be considered together. Maintenance is a large factor and mechanization is essential.

14-322. Formulas for Determining the Weights of Castings. *Foundry*, v. 74, Dec. '46, p. 167-168.

Tables cover sector of cone frustrum, hollow sphere, triangles, hexagons, and ellipsoids. (To be continued.)

14-323. Sealing of Porous Castings. Prescott C. Fuller. *Aero Digest*, v. 53, Nov. '46, p. 96, 111.

Pressure-tight castings have been produced and great savings have been realized in terms of money, foundry time and machine time on cast parts that might otherwise have been rejected, by impregnation with Laminac in modified form.

14-324. Bronze Castings, Conditions of Flow. J. T. Robertson and R. G. Hardy. *American Foundryman*, v. 10, Nov. '46, p. 59-66.

Some factors influencing laminar and turbulent flow in bronze castings investigated with gun metal, manganese bronze and aluminum bronze. The diameter of the gate was one of the most important factors governing the linear velocity of the molten metal. Laminar flow produced the best mechanical properties, surface conditions and fracture of aluminum bronze. Laminar flow also was beneficial to manganese bronze, but had little influence on mechanical properties, surface or fracture of gun metal. 17 ref.

14-325. Jobbing Work in an Indian Foundry. S. G. Athanikar. *Foundry Trade Journal*, v. 80, Oct. 31, '46, p. 209-212.

Method adopted for molding a 36-in. diameter bend and a guide vane piece required for a propeller pump.

14-326. Permanent Mold Aluminum Castings. *Light Metal Age*, v. 4, Nov. '46, p. 8-9, 37.

Equipment and operations at Aluminicast Corp.

14-327. Mechanical Pouring Unit Handles 11 Tons per Hour. J. R. Shepard and W. J. Olson. *Iron Age*, v. 158, Dec. 5, '46, p. 77-80.

At American Brake Shoe a means of pouring 370 brake shoe molds an hr. has been developed. System of centralized mechanical pouring utilizes push button control. It has succeeded in converting the pouring operation of several difficult jobs requiring five to six pourers to one requiring but one operator working in safety and comfort.

14-328. A Simple Rapid Method for Determining the Moisture Content of Sand. P. D. Liddiard and Elizabeth Seal. *Foundry Trade Journal*, v. 80, Nov. 14, '46, p. 257-260, 271.

Describes a method based on electrical properties with instructions on constructing an electrometric unit, its calibration and use.

14-329. The Fundamental Characteristics of Molding Sands. W. Davies. *Iron and Steel Institute Advance Copy*, 1946, 38 p.

Geological characteristics particularly as regards the mineralogy of the clays. Mechanism of the bonding of molding sands in the light of recent hypotheses; the effects of different types of clay on the molding properties of a sand as a whole. 84 ref.

14-330. Cast Iron. Neutralization of Sulphur by Various Alloying Elements. H. Morrogh. *Iron and Steel*, v. 19, Nov. 21, '46, p. 719-724; discussion, p. 765-766.

Melting procedure, and subsequent tests and experiments with the various elements. Results of microscopic examination.

14-331. Steel Castings. F. H. Keating. *Iron and Steel*, v. 19, Nov. 21, '46, p. 725-729.

Experimental work on their production and radiography for service at high pressure.

14-332. Coneygre Foundry. Vincent C. Faulkner. *Foundry Trade Journal*, v. 80, Nov. 7, '46, p. 231-236.

Layout; melting practice; sand preparation; green sand foundry; core making; control and inspection; dispatch; welfare; program control.

14-333. Improvements in the Manufacture of Tin Bronzes. W. T. Pell-Walpole. *Metal Progress*, v. 50, Dec. '46, p. 1221-1231.

Object of a series of researches carried out in the University of Birmingham in England was to obtain bronzes in the wrought condition which would combine the established corrosion resisting properties of high-tin bronze with better mechanical properties than could be obtained either in these

(Turn to page 30)

How Magnesium Is Adapted to Monocoque Design

Reported by Hans J. Heine
Metallurgist, Rockwell Mfg. Co.

The unusual combination of a speaker on magnesium and a discussion leader from the aluminum industry made the regular monthly meeting of the Pittsburgh Chapter a memorable success. John C. McDonald, assistant technical director, Magnesium Division, Dow Chemical Co., Midland, Mich., spoke on "Designing With Magnesium", and R. E. Sheffer, formerly chief works metallurgist and recently appointed assistant works manager, New Kensington Works, Aluminum Co. of America, led the ensuing very lively discussion.

The speaker subdivided his lecture into three parts: *(a)* the basic properties of magnesium alloys which have led to their structural use; *(b)* the suitability of magnesium alloys for simple design and monocoque construction; and *(c)* the relation of fatigue properties to service characteristics.

By way of introduction, Dr. McDonald pointed out that our conception of the structural theory is not yet in perfect shape. Moreover, service stresses are probably of a vibratory nature, which can induce fatigue. Structures are not only required to carry static loads but also the service loads.

Consumption of magnesium, according to the speaker, was 6,000,000 lb. per year before the war. During the war, yearly capacity was increased to 600 million lb., over half of which was used for nonstructural purposes. Properties which have led to this outstanding increase in output are magnesium's specific gravity of 1.8 which makes it the lightest of any structural material. Coupled with this property, the low value of the modulus of elasticity makes for high resistance to inertial loading.

Dr. McDonald suggested that more attention be paid to the excellent resilience of magnesium, a property which until now has been insufficiently taken into account. Magnesium's machinability is the highest of all structural materials. Other properties of importance are the ability of sheet to be deep drawn when heated and its good resistance to atmospheric exposure.

The chief alloying element in the past has been aluminum, and zinc is second in importance. Zirconium has only recently been investigated and has been found particularly useful for increasing the extrusion speeds obtainable. The speaker noted that close control of impurities will greatly increase the resistance to salt water corrosion.

Turning to practical applications, Dr. McDonald illustrated how magnesium can be used in semimonocoque and monocoque construction. Since column action is an important aspect of structural design, we can increase the bulk in magnesium columns and still save weight even though carrying the same load as compared with other structural materials. From a foundry standpoint, too, the principles of monocoque design are quite desirable.

In concluding, the speaker mentioned that the importance of surface finish with respect to fatigue properties should not be underestimated.

In the discussion, Dr. McDonald pointed out that magnesium has good bearing properties and that it is more susceptible to microshrinkage than aluminum.

Herzog Gets Past Chairman's Certificate

George Herzog (Right) Receives Past Chairman's Certificate From W. A. Mudge, Present Chairman, New York Chapter, at Recent President's Night

Reported by E. M. Sherwood
Metallurgist
Sperry Gyroscope Co., Inc.

Derivation of hardness "U" curves from hardenability curves was one of the interesting aspects explained by A.S.M. National President Alfred L. Boegehold in his talk on "Correlation of Recent Data on Hardenability" before the New York Chapter on National President's Night, Nov. 4. Mr. Boegehold's talk will be presented before a large number of A.S.M. chapters during the winter season and therefore will not be reported in detail here.

George Herzog, who served as technical chairman of the meeting, was presented a framed certificate for his splendid work as past chairman of the New York Chapter during 1945-46.

The National President's Night meeting was preceded on Oct. 10 by a "reconfusion" banquet and smoker at the St. George Hotel, Brooklyn, which brought out over 500 A.S.M. members and guests for fun and prizes.

When you need
LABORATORY CHEMICALS OR APPARATUS
HARSHAW SCIENTIFIC
Can Meet Your *Requirements*

More than 25,000 items are carried in stock by Harshaw Scientific Division of The Harshaw Chemical Co. • Your requirements can be filled, whether you need chemicals and apparatus for a single experiment, or to furnish a complete laboratory. • Branch offices and stocks are maintained in convenient locations to help you obtain your requirements within a short time. • Send your order, with confidence, to the Harshaw Scientific office nearest to you—Cleveland, Cincinnati, Detroit, or Philadelphia.

HARSHAW
HARSHAW SCIENTIFIC
DIVISION OF THE HARSHAW CHEMICAL CO.
CLEVELAND 6, OHIO

alloys in their normal cast condition or in lower tin bronzes in the wrought condition. Fabricating difficulties investigated; new flux process devised; new theory of inverse segregation.

14-334. 1,000,000 Pounds of Small Die Castings. Herbert Chase. *Steel*, v. 119, Dec. 23, '46, p. 56-58, 99-100.

Procedures used in production of die-cast zinc alloy hardware at Fisher Body's Ternstedt plant in Detroit. Control methods stress high surface smoothness to minimize polishing before plating.

For additional annotations indexed in other sections, see:

3-250-260; 4-122; 16-125-128; 19-307; 24-211; 25-127.

15 SALVAGE AND SECONDARY METALS

15-28. Metallizing Salvages Material and Cuts Maintenance. *Coal Age*, v. 51, Nov. '46, p. 90-91.

Details of how process is applied by a coal mining and processing company.

15-29. Scrap Recovery. F. F. Poland. *Metal Industry*, v. 69, Nov. 29, '46, p. 448-450.

New process for the refining of secondary copper-base metals and a specially designed high-temperature electric resistor furnace used in the process for the distillation of zinc from these metals. Process was used for the conversion of nickel-silver to cupronickel and to recover the zinc content in metallic form. Also proved economical for reclaiming copper and zinc from scrap brass. (Paper presented to the A.I.M.E.)

15-30. Salvaging and Reclaiming Scrap. *Steel*, v. 119, Dec. 16, '46, p. 90, 142-145.

Worn-out equipment amounting to almost 50,000 tons annually yields important savings at railroad scrap reclamation plant.

15-31. Reclamation of Aircraft Aluminum. G. W. Birdsall. *Metal Progress*, v. 50, Dec. '46, p. 1232-1238.

Methods developed at Reynolds Louisville plant No. 5 have kept the costs well in line. Reclaimed metal is of such purity that no sweetening is required to make it suitable for use in wrought or cast products conforming to present-day specifications.

16 FURNACES AND FUELS

16-125. New Annealing Ovens Provide Various Economies. Louis Belden. *Foundry*, v. 74, Dec. '46, p. 126.

Three innovations in annealing oven design at Canton Malleable Iron Co., Canton, Ohio.

16-126. Fuel Economy. Leslie Aitchison. *Metal Industry*, v. 69, Nov. 1, '46, p. 364-366.

Possibilities in the fabrication of nonferrous metals.

16-127. Factors Affecting Furnace Electrode Selection. T. L. Nelson. *Western Metals*, v. 4, Nov. '46, p. 24-26.

Extent of importance and variety of uses of carbon or graphite electrodes; costs and various steps in manufacture.

16-128. Cupola Melts Above Rated Capacity. Pat Dwyer. *Foundry*, v. 74, Dec. '46, p. 98-101, 233, 234.

Operation and construction of two cupolas of Forest City Foundries Co., Cleveland, which melt far above rated capacity.

16-129. Fuel Utilization and Economy in the Refractories and Heavy Clay Industries. E. Rowden. *Refractories Journal*, v. 22, Oct. '46, p. 321-333.

Fuel conservation in both intermittent and continuous kilns for firing the refractory materials and building materials.

16-130. Arc Furnace Switching. L. W. Long and J. F. Chipman. *Iron and Steel Engineer*, v. 23, Nov. '46, p. 53-59; discussion, p. 59-61.

Selection and maintenance of electric arc furnace switching devices; details of air blast interruption switches manufactured by Allis-Chalmers.

16-131. Electric Steel Furnace Transformers. A. G. Arend. *British Steelmaker*, v. 12, Nov. '46, p. 553-556.

Design and operation.

16-132. Fuel Economy. (Concluded.) Leslie Aitchison. *Metal Industry*, v. 69, Nov. 8, '46, p. 385-386.

Possibilities in the fabrication of nonferrous metals. Tables show power used in hot rolling, and in heating for rolling; fuel consumption in melting and fuel consumption in reheating.

16-133. Some Factors Which Influence the Efficient Utilization of Fuel in Industrial Furnaces. A. J. Thompson. *Gas Times*, v. 49, Nov. 9, '46, p. 124-126.

Effects of excess air, of insufficient air, of insulation, of heat recovery by recuperators and regenerators, on optimum production rates in metallurgical, ceramic, and other materials processing furnaces. Formulas, charts, and tables included.

16-134. Port Design and Openhearth Flames—I, II, and III. *Iron and Steel*, v. 19, Nov. 21, '46, p. 759-765.

Discussion of report on "Port Design and Open-Hearth Flames", by J. H. Chesters and M. W. Thring (see Item 27-172). Special instruments and technique; thermal conditions; general conclusions of report.

16-135. Air-Fuel Ratio Controls Oil-Fired Soaking Pits. L. E. Browne. *Steel*, v. 119, Dec. 23, '46, p. 68, 70.

Installation in which introduction of products of combustion blankets ingots with controlled neutral atmosphere. Heating is uniform, resulting in increased yield and decreased scale.

For additional annotations indexed in other sections, see:

2-156-159; 11-103; 13-48; 17-61; 18-263-273; 25-132; 27-171.

17 REFRACTORIES Furnace Materials

17-55. Comments on the German Refractories Industry as Investigated in 1945. Stuart M. Phelps. *American Refractories Institute Technical Bulletin* no. 84, Oct. '46, 11 p.

The manufacturing methods used and also the methods of application in the iron and steel industry are described. Drawings show some design details, such as construction of an openhearth roof.

17-56. German Refractory Materials. Alfred B. S. Searle. *Refractories Journal*, v. 22, Oct. '46, p. 334-336.

Great care and skill with much attention to detail are exercised in the German works, but little really noteworthy in manufacturing technique or equipment was encountered. (Summary of reports issued by the British Intelligence Objectives Sub-Committee.)

17-57. Rammed Refractories in Electric Furnaces. Robert H. Zoller. *American Foundryman*, v. 10, Nov. '46, p. 67-69; discussion, p. 69-70.

Selecting a refractory for the job; developing routine methods for refractory installation and preparing the unit for service. Drying and preheating are important factors in lengthening refractory life and decreasing foundry operating costs.

17-58. Toward Longer-Lived Abrasives. L. E. Browne. *Steel*, v. 119, Dec. 2, '46, p. 104-105, 142, 144, 146.

New development whereby final grain is produced for first time in electric furnace, obviating crushing and milling. Highly irregular plane surfaces retained in wheel face after bonding greatly increase cutting efficiency.

17-59. The Action of Carbon Monoxide on Refractory Materials. Part VII. Some Aspects of the Catalytic Action of the Ferruginous Glass of Iron Spots. F. H. Clews, F. Ball, and A. T. Green. *Transactions of the British Ceramic Society*, v. 45, July '46, p. 251-255.

Samples of a ferrous alumino-silicate glass were prepared by heating metallic iron on a firebrick at 1350° C. Glass was ground and passed over a magnet to remove particles of magnetite or metallic iron. Its behavior toward carbon monoxide at 450° C. was examined directly, after heating in carbon monoxide or hydrogen at 900° C., and after heating in oxygen at 900° C. The glass was almost inert when exposed directly to carbon monoxide at 450° C. but reacted when exposed to the other treatments. Results are used to explain the behavior of firebricks in service on the assumption that after a hard kiln firing the constitution of the iron spots resembles that of the glass used in the experiments. (Reprinted from *Bulletin of the British Refractories Research Association*, no. 68, Feb. '45.)

17-60. The Behavior of Refractory Materials Under Stress at High Temperatures. Part V. F. H. Clews, H. M. Richardson and A. T. Green. *Transactions of the British Ceramic Society*, v. 45, July '46, p. 255-268.

Reviews previous papers of this series on behavior of porcelain and fireclay in torsion at 900 to 1100° C. Nonrecoverable deformation is shown not to be of a simple viscous character in that the rate is not proportional to the stress. From experiments on fireclay and porcelain materials in compression at 1250 to 1400° C. it is evident that the rate of deformation increasingly accelerates as the load is increased. 14 ref. (Reprinted from *Bulletin of the British Refractories Research Association*, no. 68, Feb. '45.)

17-61. Gas and Air Port Blocks. J. R. Rait. *Iron and Steel*, v. 19, Nov. '46, p. 587-589, 616.

New technique for the construction of this type of gas and air port block using special, large, rectangular silica bricks undercut to give the correct pitch of port, in place of arches in the gas and air ports, provides horizontal foundations for the brickwork on top. Gas and air ports thus constructed have had greater mechanical stability in service and longer life. Hot repairs to the gas and air port blocks are carried out with much greater ease and speed than with arched ports, because centers are not required and the bricklaying is greatly simplified.

17-62. Obtaining Caustic Magnesite From Electric Furnace Slag. A. M. Kuznetzov. *Journal of Applied Chemistry* (U.S.S.R.), v. 19, no. 4, '46, p. 385-390. (In Russian.)

Investigation resulted in the establishment of optimum operating conditions and temperatures for the calcination of electric furnace slags. These slags are a new source of raw material suitable for the production of magnesite cement.

For additional annotations indexed in other sections, see:

16-129-134; 27-171-172.

(Turn to page 32)

Stainless Fabrication and Uses Discussed

Roy B. Nelson (Left), Chairman of the West Michigan Chapter A.S.M., and R. J. Henke of Allegheny Ludlum Steel Co., in Conversation at the Head Table. Mr. Henke addressed the November meeting

Reported by Ray E. Cross
Chief Metallurgist
Michigan Light Alloys

At the first joint meeting to be held by the West Michigan Chapters of the A.S.M. and the American Society of Tool Engineers, R. H. Henke of Allegheny Ludlum Steel Corp. was the speaker on "Application and Fabrication of Stainless Steels". Mr. Henke confined his attention to the straight chromium and chromium-nickel steels, and based his discussion on the point of view that physical and chemical properties determine how and where the stainless steel alloys can be used.

How small variations in chemical composition of the chromium-nickel alloys will produce a wide variety of remarkable and useful mechanical properties, was pointed out. The alloys having a low rate of work hardening are suitable for spinning operations, Mr. Henke said; alloys having a medium rate of work hardening are suitable for deep drawing work, and alloys having a high rate of work hardening can be used as structural members.

Importance was placed on how the corrosive properties of chromium-nickel stainless steels are affected by heating. Carbide precipitation was discussed and several methods of controlling this phenomenon were suggested.

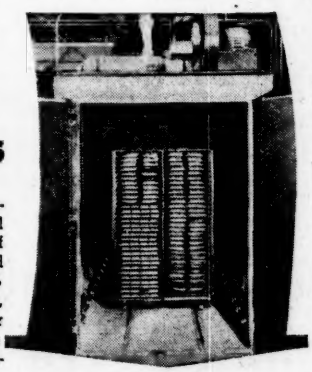
Brazing is not recommended for the austenitic stainless steels since it destroys the alloy's corrosion resistance. Soft soldering and silver soldering are being used in industry.

Mr. Henke accompanied his discussion with suitable slides and charts and concluded with the presentation of two interesting and informative films entitled "Welding of Austenitic Stainless Steels" and "Exploring with the Microtimer".

Tool Co. Announces Expansion

Independent Pneumatic Tool Co. of Chicago, manufacturer of portable pneumatic and electric tools, announces a $1,000,000 expansion of its main works at Aurora, Ill. Site for the expansion has been cleared adjacent to the company's main plant, and construction of the annex, which will provide 85,000 sq. ft. of additional floor space for production purposes, will begin shortly.

EVAPORATION TIME
REDUCED 33 1/3%
with
BURDETT
(The Original)
INFRA-RED GAS BURNERS



To the volumes of case histories publicized over several years giving positive proof of Burdett's consistent infra-red savings ranging from 33⅓% to 76⅔% in drying, cooking, baking, evaporating and other heat processes we add this Barwood Products Co. installation. Operating at 210° F., Burdett Infra-Red Burners evaporate water from wood pulp in only ⅔ the time required by the previous method. Note the solid racking of material on truck.

These remarkable savings can also apply to your production.

Get the Facts!

3407 West Madison Street, Chicago 24, Illinois

BURDETT MANUFACTURING CO.
Infra Red Gas Burners

The constant high temperatures (up to 2550° F) of Sentry Model V Furnaces *burn samples quicker* but do not burn out linings. Furnaces installed nine years ago are still giving thoroughly satisfactory service.

The Furnace and Special Porcelain Tube are designed to assure a uniformly heated chamber . . . Refractories and Insulating Materials are the best obtainable . . . Specially designed Heating Elements assure rapid heating and air-cooled terminals give maximum service.

Single and dual tube furnaces available with 1", 1⅛" or 1¼" bore tubes. Send for Bulletin 1016-1A.

The Sentry Company
FOXBORO, MASS., U. S. A.

18 HEAT TREATMENT

18-253. Heat Treatment of High-Tensile Aluminum Alloy Sheet. J. G. Gwatkin. *Aircraft Production*, v. 8, Nov. '46, p. 527-528.

Revision of existing methods. Some typical proof and maximum stresses now being obtained by double heat treatment followed by artificial age hardening are shown in table, which includes for comparison some of the better-known naturally aging materials.

18-254. Induction Hardening in Lead Screw Production. C. H. Parks and J. Libech. *Machinery (London)*, v. 69, Oct. 17, '46, p. 489-492.

By substituting localized hardening of the finished lead screw thread for through hardening of the lead screw bar, elongation and distortion are greatly decreased and grinding time is reduced by more than half.

18-255. A New Approach to the Problem of Protecting Magnesium During Heat Treatment. Davidlee Von Ludwig. *Industrial Gas*, v. 25, Nov. '46, p. 15-18, 28, 30-34.

Fires in a magnesium alloy heat treating oven are generally caused by too rapid heating, which causes melting and oxidation of the beta phase. In conventional practice, SO_2 is used to suppress oxidation. However, this has a corrosive action. Therefore, direct circulation of fuel gas combustion products is recommended. This process is successfully used by Superior Bearing Bronze Co. in Brooklyn.

18-256. Relief of Stresses in Steel Products. *Materials & Methods*, v. 24, Nov. '46, p. 1225.

Some data on the thermal relief of internal stresses in steel castings and wrought steel weldments graphically summarized.

18-257. A New Heat Treating Atmosphere Producer. A. G. Hotchkins and H. M. Webber. *Iron Age*, v. 158, Nov. 21, '46, p. 48-55.

New technique, whereby heat energy formerly wasted is effectively applied in furnishing heat to the gas producing system, has resulted in considerable reductions in cost and space considerations. Newly devised flow charts; various aspects of Neutralene as an effective heat treating atmosphere.

18-258. Some Aspects of Nitriding. S. A. J. Sage. *Metallurgia*, v. 34, Oct. '46, p. 299-303.

Nitriding is shown to require extremely careful technique to avoid unexpected variations in the finished material. Some of the problems which arise, and how to solve them. Illustrated by charts and photomicrographs showing effects of variations in treatment techniques.

18-259. Shortcuts in Spring Manufacture. Walter F. Whiteman. *Steel*, v. 119, Nov. 25, '46, p. 72-74.

Spring leaves sheared from flat rolled steel are heat treated uniformly, and simultaneously quenched and cambered in semiautomatic furnaces and machines which have increased plant's output 15%.

18-260. Bright Hardening Stainless Steel. *Steel*, v. 119, Nov. 25, '46, p. 80, 82.

Bright finish is retained in hardening process using cracked ammonia atmosphere to eliminate moisture and prevent any oxidation of the surface chromium.

18-261. Hardness and Hardenability. J. W. Donaldson. *Metal Treatment*, v. 13, Autumn '46, p. 169-181.

Reviews some of the research work carried out in the past few years in the United States. The well-known Jominy test has certain limitations and other tests have been developed which give improved results. Experiments have been made on the effect of prior structure, the effect of the percentage of martensite present and on the hardenability of cast steel of varying composition and grain size. 26 ref.

18-262. Fundamentals of Annealing Low-Carbon Steel. G. Sachs, L. J. Ebert, G. B. Kasik, and J. F. Nejedlik. *Iron and Steel Engineer*, v. 23, Nov. '46, p. 88-98.

Results of an extensive experimental study conducted at Case School of Applied Science to obtain a complete picture of the factors which determine the properties of annealed, low-carbon steel strip. Includes effects of cold work; effect of annealing time and temperature; basic hardening effects; and effect of cooling rate. Results are presented graphically.

18-263. Hardening and Tipping Tools in a Carbon Muffle. E. F. Watson. *Machinery (London)*, v. 69, Oct. 24, '46, p. 517-519.

In operation, the carbon block, supported by a silicon-carbide muffle, is placed in the furnace and brought up to the hardening temperature. The steel to be hardened is placed on a refractory tray inside the carbon block. The air in the block reacts with the carbon to produce the protective atmosphere. Furnace specially built to use the carbon muffles, and assembly of the furnace muffle, carbon muffle and refractory tray are shown.

18-264. A Discussion of Prepared Furnace Atmospheres. Charles E. Thomas. *Steel Processing*, v. 32, Nov. '46, p. 733-738.

Applications of various types of special furnace atmospheres. Danger of contamination with air and moisture; use of metallic lithium to nullify the action of oxygen, CO_2 and water vapor.

18-265. Cast Steel, Homogenization Heat Treatments. Part I. John G. Kura and Philip C. Rosenthal. *American Foundryman*, v. 10, Nov. '46, p. 22-38.

Effects of homogenizing heat treatments of 2, 6, or 12 hr. at 1650, 1750, 1850, 1950 or 2050° F., and of 12 hr. at 2250° F., on the hardenability and mechanical properties of five hardened and tempered commercial 2-in. cast plates from five different producers were determined. Any deviations that arose were more closely related to position of test pieces in original plate than to influence of homogenizing heat treatment. The various homogenizing treatments produced no appreciable change in the characteristics of the hardened and tempered specimens of these five low-alloy steels.

18-266. Prepared Atmospheres. C. C. Eeles, and M. E. Shriner. *Steel*, v. 119, Dec. 2, '46, p. 110-113, 154, 155.

A codification of all prepared furnace atmospheres is presented as an aid in selecting suitable atmospheres for the greatly varied processing of metals.

18-267. Some Investigations on the Heat Treatment of Sheet Steel for Cold Pressing. T. Yourtaieff. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2116-2120, 2124.

Experiments include a study of basic bessemer rimming steel sheet as well as a few results on the heat treatment of killed steel deep drawing sheet. Chief problems were rates of heating and cooling, time of soaking, and partial annealing and other special treatments. Final part of investigation was devoted to tests on the aging of sheets after the heat treatments previously studied. Thus work was limited to rapid cooling speeds. (To be continued.)

18-268. Internal Stresses in Aluminum Alloy Parts. L. E. Benson. *Engineering*, v. 162, Nov. 15, '46, p. 463.

Normal heat treatment applied to many aluminum alloys involves quenching and subsequent precipitation hardening. This treatment often sets up internal stresses of dangerous magnitude. Tests were made over a range of temperatures to investigate the possibility of these stresses being relieved by plastic flow during the precipitation hardening treatment. Freedom from internal stress was obtained by quenching in water at 100° C. This process resulted in less sacrifice of strength and elasticity than final stress-relief annealing.

18-269. Buyer Reluctance Retards Switch to H-Band Steels. *S.A.E. Journal*, v. 54, Dec. '46, p. 72.

Data show that H-band spreads are actually much closer than hardenability spreads resulting from chemistry specifications—something like 70 to 80% of the chemistry spread. This contention is well illustrated by graph. Reports from users are needed showing benefits already accrued from using H-band steels. Reports should be based on characteristics exhibited during heat treatment, including information on such phases as quenching media, tempering temperature, and cracking.

18-270. The Nitriding of High Speed Steel Tools in Salt Baths. E. F. Watson. *Machinery (London)*, v. 69, Nov. 21, '46, p. 662.

Advantages of treatment; required temperatures; necessity of avoiding contamination and nonuniformity. Times for various tools are shown in table.

18-271. Gas Cyaniding. H. M. Parshall. *Steel*, v. 119, Dec. 16, '46, p. 86-88.

Useful method of casehardening, especially for parts made of low-carbon, non-alloyed steels such as S.A.E. 1020 and 1112. Process consists of exposing parts, at proper temperature, to gaseous medium containing carbon and nitrogen.

18-272. Gas Carburizing. Ivor Jenkins. *Iron and Steel*, v. 19, Nov. 21, '46, p. 698-708.

Mechanism of carburization; carburization with town gas and with butane; carburization with diluted propane; carburization with carbon monoxide and hydrogen atmospheres; nature of the steel surface and its effect upon the rate of carburization; effect of temperature on carburization.

18-273. Coiled Strip Annealing. B. Jones and I. Jenkins. *Iron and Steel*, v. 19, Nov. 21, '46, p. 747-750; discussion, p. 769-770.

New electric annealing plant installed at works of the Whitehead Iron and Steel Co., Ltd., Newport, Mon., England, in 1944, for the bright annealing of cold rolled, mild steel strip in coils. Consists of the vertical cylindrical or batch type furnaces.

18-274. The Nitriding of Steel. Carl F. Floe. *Metal Progress*, v. 50, Dec. '46, p. 1212-1220.

Nitriding media; structure of nitride cases; nitriding furnaces; growth in nitriding; protection against nitriding; steels for nitriding; applications of nitriding.

For additional annotations indexed in other sections, see:

3-255-264; 4-125-133-135; 8-158; 16-125-126; 22-577; 23-356.

19 WORKING — Rolling, Drawing, Forging

19-298. Laminated Plastic Jigs and Tools. *Aircraft Production*, v. 8, Nov. '46, p. 513.

Advantages of laminated bakelite in drill-and-rout templets for sheet and plate details, rubber press forming-tools and bending blocks. Table gives physical properties.

(Turn to page 34)

High Speed Vs. High Carbon, High Cr Steels for Dies Debated in Dayton

Reported by William McCrabb
Dayton Rust Proof Co.

"Effects of Modern Developments in High Speed Steel" were explained by a dual team when Leonard C. Grimshaw and Ray P. Kells of Latrobe Electric Steel Co. took over for the Dayton Chapter meeting on Nov. 13.

In the main address, Mr. Grimshaw, who is chief metallurgist for Latrobe, divided the high speed steels into groups and discussed their general uses and limitations. Following this breakdown the latest developments in heat treating cycles were given and an explanation of the various modern theories of hardening these steels. His talk has been reported previously.

Mr. Kells, chief service engineer for Latrobe, conducted the discussion period. One comment made at this time concerned the use of high speed steel versus high-carbon, high-chromium air hardening steel in the making of lamination dies. In the Dayton area high speed steels are in general use for this purpose, although it is believed that the other composition would make very satisfactory dies. The point was brought up that the total overall cost of making dies from high speed instead of high-carbon, high-chromium steel should be less, because of the steel's better machinability. If this be true, then fewer man-hours would result in lower die costs. Possibly more investigation of this point would be beneficial.

Ray P. Kells (Left) and Leonard C. Grimshaw (Center) Talk Over Some Knotty Problems in High Speed Die Steels With an Unidentified Member of the Dayton Chapter

Acid Steelmaking Traced in Detail

Reported by A. R. Kunkle
Project Engineer, York Corp.

A plant visitation through the Central Iron and Steel Co. in Harrisburg, Pa., was a fitting prelude to the dinner and technical meeting of the York Chapter on Nov. 13 when "Acid Openhearth Steelmaking" was the subject.

The evening program was presented by George S. Baldwin and Edward E. Callinan, respectively chief metallurgist, and superintendent of the open hearth department, Standard Steel Works Division, Baldwin Locomotive Works, Burnham, Pa. Mr. Callinan presented the paper and Mr. Baldwin led the discussion.

Mr. Callinan described the physical and chemical factors involved in the furnaces and materials used in acid steelmaking, the acid slag, and melting control methods. Then by use of slides the manufacture of two actual heats of acid steel of different grades was traced in detail from the charge compositions to the final ingot products.

The discussion period that followed brought out additional features of slag-metal relations and the effects of final deoxidizers and alloys on physical properties.

A Must FOR LONG SERVICE LIFE!
THERMALLOY RETORTS

SPECIFY THERMALLOY

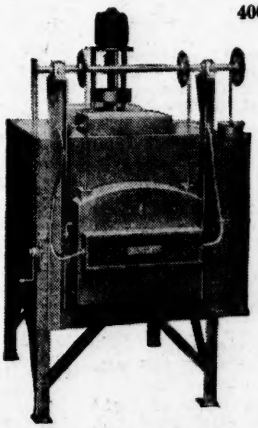
MUFFLES
BASKETS
FLEX BOXES
POTS··CHAIN
TRAYS··FURNACE PARTS
SPECIAL DESIGN CASTINGS

R-340

AMSCO ALLOY and THERMALLOY are identical

AMERICAN Brake Shoe COMPANY
ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO.

HEVI DUTY "MULTI RANGE"
Box Type Convection Furnaces
400° F to 1850° F



Type HD-243618-A, 40 KW, "Multi Range" Convection Box Furnace

- USE OVER A WIDE RANGE OF TEMPERATURES WITH
- HIGH DEGREE OF UNIFORMITY
- USE WITH OR WITHOUT FAN AGITATION
- USE WITH OR WITHOUT PROTECTIVE ATMOSPHERE
- PLAIN OR ROLLER RAIL HEARTH

Send for Bulletin HD-341

HEVI DUTY ELECTRIC COMPANY

19-299. Dimpling Light-Alloy Sheet. *Aircraft Production*, v. 8, Nov. '46, p. 536-540.

Investigations into the use of high-temperature methods.

19-300. New Method of Wire Straightening. G. E. Shubrooks. *Materials & Methods*, v. 24, Nov. '46, p. 1230.

Straightening machine built by Hamilton Watch Co. uses hardened steel dies with an extremely high polish.

19-301. Stamped Bushings. D. B. Wilkin. *Steel*, v. 119, Nov. 25, '46, p. 64-66, 104.

Intricate and highly accurate progressive dies make stamping press a volume producer of tubular-shaped bushings and bearings. Steel and bronze are worked interchangeably on most setups.

19-302. Can You Draw Aluminum? E. V. Sharpnack. *Modern Industrial Press*, v. 8, Nov. '46, p. 22, 24-26.

Selection of the proper alloy, design of the part, and calculation of the number and type of draw operations and of blank size. (To be continued.)

19-303. Production at Preco. C. S. McElrath. *Modern Industrial Press*, v. 8, Nov. '46, p. 30, 32, 38.

Equipment and methods utilized in manufacturing presses and fans for railroad cars.

19-304. A Tooling Program for Forged Globe Valves. Carl F. Benner. *Tool & Die Journal*, v. 12, Nov. '46, p. 78-82.

Procedure followed in manufacturing the forged body of the brass offset globe valve.

19-305. Strengthening Metal Parts by Shot-Peening. H. F. Moore. *Iron Age*, v. 158, Nov. 28, '46, p. 70-76.

Phenomenon of metal fatigue and the effect of shot-peening thereon. Factors leading to the development of fatigue fractures and an explanation of the function of shot-peening in strengthening metals. Results of numerous fatigue tests of peened and unpeened metal are tabulated and corresponding S-N diagrams are given.

19-306. German Bimetal Tubing. *Iron Age*, v. 158, Nov. 28, '46, p. 76.

A process for producing steel tubing with copper or bronze plating or cladding (inside or outside or both) at a German plant.

19-307. A Zinc-Alloy Die Foundry. *Engineer*, v. 182, Nov. 15, '46, p. 440.

Use of Kirksite, an 83% zinc alloy, in the making of sheet metal press tools.

19-308. Punch Press Protector. John Isaacs. *Electronics*, v. 19, Dec. '46, p. 101-103.

When the slugs formed by a punch press are not cleared within 3 sec., an electronic timer shuts off power. In normal operation slugs evacuated through a sensing unit prevent the timer starting.

19-309. The Rolling of Metals: Theory and Experiment. Part XIII. (Continued.) L. R. Underwood. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2105-2115.

Torque, deformation work, and rolling horsepower. (To be continued.)

19-310. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2127-2131.

Deep drawing. (To be continued.)

19-311. Extrusion. H. A. Unckel. *Metal Industry*, v. 69, Nov. 22, '46, p. 423-425.

Experimental work carried out on a series of alloys of copper, lead, tin, zinc. Effect of the application of an envelope of plastic metal on the development of cracks from the periphery of the rod at its exit from the die orifice is reported. (To be concluded.)

19-312. Strengthening Metal Parts by Shot-Peening. Part II. H. F. Moore. *Iron Age*, v. 158, Dec. 5, '46, p. 81-86.

Phenomenon of metal fatigue and the effect of shot-peening. Effect of peening on fatigue fractures in regions of high compressive stress is explored in particular detail and comments are given on the offsetting by peening of stress concentrations, holes, fillets and notches, and of decarburization. Precautions necessary to obtain optimum results with shot-peening.

19-313. Featherweight Wheelbarrow Formed From Magnesium. Chester S. Ricker. *American Machinist*, v. 90, Dec. 5, '46, p. 101-103.

Only three machines are required to make the Dowcraft "Lawnbarrow", a 12-lb. wheelbarrow that is all magnesium alloy except the wheel assembly and five bolts. One hydraulic press forms the hopper, another rolls its edge, a brake forms the leg and brace. Handles are bent in hand fixtures on a bench.

19-314. Improved Methods of Armature-Core Production. *Machinery (London)*, v. 69, Nov. 21, '46, p. 657-661.

By assembling the blanked laminations strictly in the sequence of their production, the filing of armature winding slots is dispensed with. Also by using special fixtures and press tools, assembling is quicker and more accurate.

19-315. The Manipulation of Magnesium Alloy Sheet and Extrusions. G. Goddard. *Magnesium Review and Abstracts*, v. 6, July '46, p. 89-101.

Review of published information to August 1945 covers plastic deformation; commercial alloys; preparation of blanks for forming; preheating of blanks; drawing presses; heating and design of press tools; tool materials; lubrication; forming procedure. (To be continued.)

19-316. Extrusion. H. A. Unckel. *Metal Industry*, v. 69, Nov. 29, '46, p. 445-447.

Some experimental work on hot-short alloys including effect of coatings, causes of hot shortness, susceptibility to cracking, high-temperature brittleness in duralumin type alloys. 4 ref.

19-317. Cold Reduction Reversing Strip Mill. *Engineer*, v. 182, Nov. 29, '46, p. 493.

New 80-in. cold reduction reversing strip mill installed recently in England.

19-318. Ingenious Work-Transfer Mechanisms for Progressive Dies. Charles O. Herb. *Machinery*, v. 53, Dec. '46, p. 139-147, 161.

Salient features of unique dies and their feeding arrangements, designed by Ford engineers for performing as many as ten press operations with one handling of the work.

19-319. Mill Practice—the Care and Maintenance of Dies. R. R. Preston. *Wire and Wire Products*, v. 21, Dec. '46, p. 957-960, 996-997.

Mill layout, scheduling, cleaning, lubrication, dieroom layout and care of dies with special emphasis on last two items.

19-320. Thread Rolling—Theory and Practice. J. W. Batchelder. *Iron Age*, v. 158, Dec. 19, '46, p. 58-64.

Thread rolling machines and practices are explained in detail. Some of the basic concepts of thread rolling and the evolution of thread rolling equipment. (To be continued.)

19-321. Die Erhohung der Kriechgrenze durch Kaltreckung. (Effect of Cold Working on Creep Strength.) H. Zschokke. *Schweizer Archiv*, v. 12, Oct. '46, p. 297-304.

Effect of cold working on creep strength at elevated temperatures of three 18-8 steels containing W, Ti, Ta, Cb, and Mo. Additional tests were used to determine effect of rolling temperature on creep strength. 15 ref.

19-322. Precision Forging of High-Temperature Alloys. C. H. Smith, Jr. *Iron Age*, v. 158, Nov. 28, '46, p. 42-46.

Metallurgical and mechanical considerations involved together with a detailed description of the operation sequence.

For additional annotations indexed in other sections, see:

3-265; **4**-129-133-134-136; **16**-132-135; **18**-259-267-273; **20**-531; **21**-108-110-112; **23**-343-345-357; **24**-202-203-204-205-208-209-213; **25**-130.

20 MACHINING AND MACHINE TOOLS

20-495. The Broaching of Brasses and Bronzes. Part I. Harry H. Gotberg. *Tool & Die Journal*, v. 12, Nov. '46, p. 87-92.

Classifies machinability of copper, brass and bronze and discusses various features of broach design.

20-496. Modern Production Equipment. Joseph Geschelin. *Automotive and Aviation Industries*, v. 95, Nov. 1, '46, p. 30-35, 58, 60.

Modern equipment, conveyerization and mechanization of operations and assembly lines, as well as the introduction of advanced methods at Studebaker plant. Connecting rod assembly—operation and equipment.

20-497. The New Involute Spline Standard. The Broaching Institute. *Tool Engineer*, v. 17, Nov. '46, p. 27-29.

New system provides for remarkable advantages and flexibility in design.

20-498. Milling Attachments and Accessories. John E. Hyler. *Tool Engineer*, v. 17, Nov. '46, p. 41-44.

Various types of standard commercial appliances which widen range and versatility of horizontal and vertical millers.

20-499. New Abrasive Reduces Grinding Costs. John Anthony. *Iron Age*, v. 158, Nov. 21, '46, p. 56-59.

Extended field tests on a new type of fused alumina abrasive indicate the possibilities for lowered cost in grinding operations. Advantages include the need for fewer redressings and cooler and faster cutting. In addition to a discussion of the results of comparative tests, outstanding features are included.

20-500. Buick Modernizes Cylinder Bore Production. H. E. Linsley. *Iron Age*, v. 158, Nov. 21, '46, p. 65-68.

Precision boring and honing, air gaging, and selective piston fitting are combined with a chemical treatment to produce desired results.

20-501. How to Measure Machinability in the Shop. Georg Schlesinger. *American Machinist*, v. 90, Nov. 21, '46, p. 117-128.

Life-long tests of various methods of determining machinability and tool life; table of cutting speeds and a simple one-element dynamometer.

20-502. Practical Ideas. *American Machinist*, v. 90, Nov. 21, '46, p. 135-140.

Floating punch holder aligns itself in high-speed riveting. Improved centerless grinder work supports shorten setups. Wood vise jaws break nozzle bottleneck. Misaligned two-stage die saved by adjusting the guides. Hints on small tools. Positive shut-off improves exposed push-button stations.

20-503. Production Drilling of Rail Sections. *Steel*, v. 119, Nov. 25, '46, p. 66-67, 101.

New method of piercing rail sections reduces time involved as sections up to 39 ft. in length are drilled for reinforced switch points, frogs and crossings.

(Turn to page 36)

Pyrometric Progress Seen as Sum of Many Small Advances

Reported by Wylie J. Childs
Rensselaer Polytechnic Institute

The sum of a number of small advances rather than any single major development is responsible for the great progress in pyrometric methods, according to W. W. Matlack. Mr. Matlack and O. B. Wilson, both of Brown Instrument Co., presented a joint discourse on "Modern Pyrometric Practice" before the Eastern New York Chapter in November.

Among the many improvements Mr. Matlack mentioned was the use of different types of insulation for lead wires permitting operation at higher temperatures. Protective tubes made of Vicor glass may be employed up to 1800° F. if supported and up to 1600° F. if unsupported. This material provides for much faster heat transfer and consequently more rapid recording of temperature changes. Another development in protective tubes has been the substitution of Inconel for cast nichrome, thus obtaining thinner sidewalls at less cost. A still cheaper tube to substitute for nickel alloys in salt or cyanide pots is composed of ordinary iron pipe with a sillimanite liner.

In the field of thermocouples, the speaker mentioned the use of nickel, nickel-molybdenum couples in atmosphere furnaces since they are less expensive than platinum, platinum-rhodium couples.

Mr. Wilson then took the platform and gave a brief description of the development of indicating and control equipment from the original millivolt type to the modern electronic controller. The features desired in an industrially used control are accuracy, close control, simplicity of construction, ruggedness, speed of operation and long life.

The original millivolt type of control provided simplicity of construction, speed and some ruggedness but did not give adequate accuracy or sensitivity of control. These latter two requirements were met in the potentiometer style of controller, but the necessity of using a sensitive suspension galvanometer in this instrument made it much less resistant to external shock. Futhermore, since a considerable length of time is necessary for balance to be reached, the device always lags behind actual temperature changes.

The electronic temperature control combines accuracy and sensitivity with speed of operation and relative ruggedness and simplicity. Instead of utilizing a galvanometer, the unbalanced current is amplified electronically and used to drive a controlling motor directly. In this way the apparatus is simplified and the cycle time lag eliminated, permitting balance in a small fraction of a second. Sensitivity is such that the control is operated by a temperature difference as small as three microvolts.

Specific examples of instrument applications were cited by Mr. Matlack and included multiple recording in addition to control, program or time cycle applications, differential temperature control, and the increasing demand for modulated control using air-operated controls.

After the meeting was adjourned the operation of several different types of Brown controllers was demonstrated.

Behavior of Each Alloy Element in Carburizing Shown

Reported by L. Malpoker
Metallurgist, Lincoln Engineering Co.

A. S. Jameson, assistant supervisor of metallurgy, in charge of research, International Harvester Co., and principal speaker at the November meeting of the St. Louis Chapter, began his talk on "Carburizing" with a short history dating back to the 16th century. The primary purpose of carburizing steel, he pointed out, is for a hard, wear resisting surface and a tough core, using inexpensive steels.

A case of 1.30% carbon is possible depending on heating cycle and carburizing material used. Depth of case is controlled by heating cycle and temperature. Using slides, Mr. Jameson considered each element alloyed with steel and explained its use and how it behaves in carburizing. Then a photomicrograph was shown of a carburized and slowly cooled specimen. One could readily see the hypereutectoid zone, and hypo-eutectoid zone tapering into the core of original carbon content.

Mr. Jameson gave good reasons for not quenching from the carburizing box, depending on type of steel and the part being carburized. One disadvantage is that grain growth in carburizing tends to cause distortion and brittleness. Advantages and disadvantages of the single quench and double quench after carburizing were then explained. Hardness required, type of steel, size and shape of part determine quenching medium to be used.

A particularly interesting slide showed the effects of tempering on impact values of carburized N.E. 8620 steel, and another depicting hardness vs. quenching temperature showed the effects on case and core structure.

Manufacturers —
SAVE ON PRODUCTION TIME & COSTS *through*
FABRICATION by BRAZING

Many large and small parts produced usually by machining operations from one piece of large solid stock now are being made faster, more efficiently and with greater economy through Induction Brazing and Copper Hydrogen Brazing. Fabrication by brazing can be applied to all types of ferrous and non-ferrous metals to close tolerances.

A COMPLETE SERVICE

• INDUCTION BRAZING • COPPER HYDROGEN BRAZING • INDUCTION HEAT TREATING • CARBURIZING • CYANIDE BATHS • SALT BATHS • MAGNAFLUX INSPECTION • METALLURGICAL LABORATORY • ENGINEERING SERVICE • CONTROLLED ATMOSPHERES.

A Worthy Addition to your Technical Library—
"CONDENSED GUIDE TO HEAT TREATING"
Yours for the Asking! Write for your copy on company letterhead.

Get our estimate on your next job.

Inquiries Invited

EASTERN HEAT TREATING AND BRAZING CORPORATION
250 West 54th Street • New York 19, N. Y.

20-504. **Dimpling Light-Alloy Sheet.** *Aircraft Production*, v. 8, Nov. '46, p. 344. A handy sawing method. Robert Mawson. *Materials & Methods*, v. 24, Nov. '46, p. 1229.

A short-cut method for making a die on a DoAll machine.

20-505. **Advantages of Speed in Machining.** R. Delamare. *Materials & Methods*, v. 24, Nov. '46, p. 1264-1265.

Advantages of high speed made possible by use of carbide tools are: No built-up edge is formed because of the brief contact between tool and material being cut; there is no time for secondary vibrations; power consumption is decreased while tool and machine life is increased; a better finish is obtained; the high speed causes heating and softening of the surface of the material being cut so that removal of chips is facilitated, while there is not enough time for much of the heat to be transmitted to the tool. (Condensed from *Mecanique*, v. 30, Feb. '46, p. 29-36.)

20-506. **Machining of Stainless Steels.** W. H. Crisp and W. Burnan. *Aircraft Production*, v. 8, Nov. '46, p. 529-532.

Some precautions to insure satisfactory results in turning, drilling, tapping and other processes.

20-507. **Gear Box Manufacture.** *Automobile Engineer*, v. 36, Oct. '46, p. 429-438.

Gear box incorporates certain unusual features, including constant mesh on all four speeds and a positive gear lock. Manufacturing methods employed for several important components, and operation sequences for the box itself, the mainshaft, a mainshaft gear, a sliding dog, and a center for sliding dog. All gears must pass comprehensive inspection.

20-508. **Gear Shaving.** *Automobile Engineer*, v. 36, Oct. '46, p. 443-450.

Principles underlying the process; the cutters used, both rack and rotary; chip removal; cutting fluids for the shaving operation.

20-509. **Machining Wheels and Axles for Railway Rolling Stock.** *Machinery (London)*, v. 69, Oct. 17, '46, p. 481-486.

Equipment and procedures at Taylor Bros. & Co., Ltd., England. Sequence of operations on duplex boring and turning mills, drilling and trepanning, axle machining and pressing of wheels onto axles.

20-510. **Toolmaking Methods.** *Machinery (London)*, v. 69, Oct. 17, '46, p. 493-497.

Some representative methods used in the making of special-purpose gages and tools to insure their accuracy without unduly increasing cost.

20-511. **Slot-Drilling Jig With Half-Bushing Guide for Drill.** H. Moore. *Machinery (London)*, v. 69, Oct. 24, '46, p. 515.

Jig with a reversible bushing plate for drilling three closely spaced holes through shaft to produce a crosswise slot.

20-512. **Eccentric-Clamp Application.** W. H. Litten. *Machinery (London)*, v. 69, Oct. 31, '46, p. 551-555.

How the eccentric cam may be used in a variety of ways on jigs and fixtures and in the machine shop generally.

20-513. **Blind-Bore Lapping.** H. J. Richards. *Machinery (London)*, v. 69, Oct. 31, '46, p. 556-557.

Improvements in techniques in production of master ring gages to 0.00002-in. accuracy.

20-514. **Cam to Give Longer Stroke Without Increased Operating Space.** *Machinery (London)*, v. 69, Oct. 31, '46, p. 558-559.

Cam shown serves to impart a reciprocating motion to the machine slide which is required to have a longer stroke than could be produced by a cam of conventional design and of a size which could be assembled in the recess. Cam was designed to provide the long stroke required without increasing the diameter of the cam.

20-515. **Cutting Action of Reamers.** T. F. Githens. *Transactions of the American Society of Mechanical Engineers*, v. 68, Nov. '46, p. 867-876.

Fundamental action, design, and maintenance of reamers.

20-516. **Machining Wheels and Axles for Railway Rolling Stock.** *Machinery (London)*, v. 69, Nov. 7, '46, p. 579-583.

Methods employed at the Works of Owen & Dyson, Ltd., for completely machining the wheels and axles separately, leaving the pressing-on of the wheels for the final operation. Resulting product is much more accurate than formerly, apart from the improved finish which is obtained with considerable reduction in machining times.

20-517. **Form Tools. (Continued.)** William F. Walker. *Edgar Allen News*, v. 25, Nov. '46, p. 709.

Steel-cutting carbides; composition and heat treating schedules for oil hardening, nonshrinking toolsteel. (To be continued.)

20-518. **Automatic Pneumatic-Indexing Drilling Jig.** *Engineering*, v. 162, Nov. 8, '46, p. 440-441.

Jig has been devised to reduce the time taken in clamping small components in drilling jigs and in removing them after drilling.

20-519. **Drilling Closely Spaced Multiple Holes.** *Iron Age*, v. 158, Dec. 5, '46, p. 71.

By combining two standard Zagar products, seven sizes of holes, ranging from No. 40 to $\frac{1}{4}$ in., are drilled into a socket part at very close distances. The spindles are spread over a predetermined distance, and alternate holes are drilled at various positions by the indexing method.

20-520. **Precision in Brass.** Ralph G. Paul. *Western Machinery and Steel World*, v. 37, Nov. '46, p. 92-95.

Equipment and operations at National Welding Equipment Co., manufacturers of welding torches, cutting torches, regulators and accessories for the metalworking industries, as well as a wide variety of specialized gas-air equipment items.

20-521. **Modern Methods of Gear Finishing.** Peter Starman. *Western Machinery and Steel World*, v. 37, Nov. '46, p. 100-103, 126, 129.

Importance of accuracy of gear blanks and condition of materials. Relative advantages of rack and rotary methods of gear shaving.

20-522. **Contour Machining for Material Economy.** H. J. Chamberland. *Western Machinery and Steel World*, v. 37, Nov. '46, p. 105-107.

Examples of eight applications of contour sawing, taken at random from production facts, resulting in saving of approximately 1000 lb. of die steel.

20-523. **Electric Control for Metalworking Machines.** James Van Voast. *American Machinist*, v. 90, Dec. 5, '46, p. 117-132.

Circuit elements; current "changers"; starters; adjustable-speed drives; automatic controls; wiring and standardization.

20-524. **Practical Ideas.** *American Machinist*, v. 90, Dec. 5, '46, p. 139-144.

Toolmaker's buttons establish accurate angles and straight edges. Special holder aids bolt circle and radial drilling. Handy solder holder. Hinge lifts planer tool clear of deep slots. Powered toolbit honer produces sharper tools. Flat gage repositions toolbits in square turrets. Hints on small tools. Extension center permits accuracy on old lathes. Chipbreakers brazed on when they can't be ground. Angle plate clamp for grinding setups. Hand punch and die for light sheet metal work. Soft hexagonal false jaws improve finish operations.

20-525. **Oil Casings.** J. H. List. *Iron and Steel*, v. 19, Nov. '46, p. 601-602.

Machining operations for 90° gear drive housings.

20-526. **Electronic Contouring Control.** J. M. Morgan. *Steel*, v. 119, Dec. 9, '46, p. 94-96, 116, 119.

Simplifies machining of odd-shaped parts accurately and "steplessly". Besides providing high degree of flexibility of setups, it maintains tool travel at constant linear rate.

20-527. **Notes From British Experiences in Milling Light Alloys.** E. R. Yarham. *Modern Machine Shop*, v. 19, Dec. '46, p. 124-132, 134.

Production of spar booms for aircraft as an example of the application of carbide tipped cutters in machining aluminum alloys. Methods used in Britain illustrate certain broad principles which will apply generally to the high-speed milling of such metals.

20-528. **Building High Output Diesel Engines.** Joseph Geschelin. *Automotive and Aviation Industries*, v. 95, Dec. 1, '46, p. 18-24, 37.

Operations and equipment involved in production of cylinder liner, vapor compressor cylinder, cylinder head, and blower. Advanced techniques in machining rotors and housings.

20-529. **Crushed Wheel Grinding.** J. C. Wilson. *Tool Engineer*, v. 17, Dec. '46, p. 35-39.

Early development; machine requirements; table speeds; crushing devices; crushing rolls; coolants; grinding wheels.

20-530. **Milling Attachments and Accessories. Part 2.** John E. Hyler. *Tool Engineer*, v. 17, Dec. '46, p. 46-49.

Multispindle heads; micrometer setting attachments; contouring attachments and other fixtures. (Concluded.)

20-531. **Machining Huge Aluminum Slabs on Scalper of Unusual Design.** *Machinery*, v. 53, Dec. '46, p. 150.

Machines scalp the surface of the slab to a depth of $\frac{1}{4}$ to $\frac{5}{8}$ in. in one pass of the table, thus preventing impurities from being distributed throughout the sheet in later operations. Scalping machines employed for this work are a horizontal-spindle type. In appearance and operation, they resemble a vertical-spindle milling machine that has been turned 90° to a horizontal operating position. Will handle slabs weighing from 200 to 10,000 lb. and ranging in size from 2x30x38 in. to 16x63x120 in.

20-532. **Chip-Removal and Coolant-Temperature Regulating System.** *Machinery*, v. 53, Dec. '46, p. 151-154.

Centralized collection of chips, regulated coolant temperature, and consequent increased production are advantages derived from installation which consists of chip-removal conveyers, coolant storage tanks, and a ventilation system, built as a unit and designed to serve groups of three or four machines. Installation described serves a group of four Bullard vertical turret lathes. Lathes are used for machining cast-iron automotive brake drums.

20-533. **Tool Engineering Ideas.** *Machinery*, v. 53, Dec. '46, p. 175-177.

Lathe attachment for cutting oil grooves. Fixture for grinding the under side and top of machine tool ways parallel. Automatic feeding and ejection of small cylindrical parts.

20-534. **Carbide-Ball Burnishing Cuts Bore-Finishing Cost 90%.** James Busch. *American Machinist*, v. 90, Dec. 19, '46, p. 129.

For each size of blank, a special burnishing fixture has been developed. The one for the larger blank is shown; that for smaller blank is identical but somewhat smaller in over-all dimensions.

20-535. **Practical Ideas.** *American Machinist*, v. 90, Dec. 19, '46, p. 139-144.

Floating driver speeds mandrel-mounted work. Taper pin locks taper shank boring bars. Double-eccentric circular cutters improve reaming. Ex-

(Turn to page 38)

Birmingham District Chapter Honors Sustaining Members

Reported by William W. Austin, Jr.
Metallurgist
Southern Research Institute

The 25 sustaining member companies of the Birmingham District Chapter ⊜ were guests of honor at a special banquet and technical session held recently at the Hotel Tutwiler in Birmingham. In recognition of their loyal cooperation and support of the Chapter's activities each of the 25 companies was awarded a handsome stainless steel framed A.S.M. Sustaining Membership Certificate.

Presentations were made by J. T. MacKenzie, chief metallurgist, American Cast Iron Pipe Co., and first chairman of the chapter, who paid tribute to the sustaining members' assistance in promoting the chapter's educational program. The following companies received certificates:

Alabama Clay Products Co.
Allegheny Ludlum Steel Corp.
American Cast Iron Pipe Co.
Anderson Brass Works, Inc.
Bristol Co.
Brown Instrument Division of Minneapolis Honeywell Regulator Co.
Chattanooga Welding & Machine Co.
Chicago Bridge & Iron Co.
Connors Steel Co.
Dispatch Printing Co.
DoAll Gulf Co.
F. J. Evans Engineering Co.
Firth-Sterling Steel Co.
Ingalls Iron Works Co.
Kilby Steel Co.
Morriss Steel Products Co.
Pate Supply Co.
Republic Steel Corp.
Riddell Engineering Co., Inc.
Southern Research Institute
Southern States Iron Roofing Co.
Southern Steel Works Co.
Tennessee Coal, Iron & Railroad Co.
Tool Engineering Service
Veitch Machine Co.
Vulcan Rivet & Bolt Corp.

A. E. Focke, chief metallurgist, Diamond Chain and Manufacturing Co. and A.S.M. national trustee, was the principal speaker and was introduced by M. F. Wiedl, managing editor of *Southern Machinery and Metals* and secretary of the Georgia Chapter.

In speaking on "The Metallurgist, the A.S.M. and the Metals Industry", Dr. Focke pointed out the many ways A.S.M. is serving both individuals and management of the nation's metal industry. He also emphasized that A.S.M.'s basic purpose is education and that through closer cooperation with our colleges and universities, as well as with its members in industry, A.S.M. is helping to provide better trained personnel for the metallurgical profession throughout the nation.

Corrosion & Pitting Are Main Problems In Power Plants

Reported by Russell L. Wilcox
Draftsman, Bethlehem Steel Co.

Beginning with the usual pre(h)eating ceremony, Baltimore Chapter ⊜ finished off its October dinner with a bang-up quiz program for spot cash and a colored motion picture of considerable excellence on an excellent subject: "Baltimore and the State of Maryland".

After a 15-min. period known as "stress relieving" (mentally speaking), P. M. Hess, station superintendent, Safe Harbor Water Power Corp., presented a jackpot talk on "Metals in Service". Mr. Hess spoke from a long-time standpoint as a user of metals and metal products, and in particular as a sufferer from many important metallurgical problems.

The Safe Harbor Water Power Corp. operates a large hydroelectric plant at Safe Harbor, Pa., which supplies the Pennsylvania Railroad with power. There many metals are subjected to varying conditions of service. Probably the most difficult general problem is that of corrosion. It is, as Mr. Hess pointed out, a "tough nut" and must be faced continually. Much experimentation has been carried out, particularly in the past ten years, and a great deal of interesting information has been gathered.

Second only to corrosion, though also a form of corrosion, is the problem of pitting resulting both from barnacles and from cavitation. In cavitation of turbine blades, Mr. Hess said, the solution lies in chipping out the affected areas and welding in a layer of 18-8 stainless steel. This procedure has been improved now to the point where turbine repairs are considered a comparatively simple job, almost on an equal basis with painting of the gates.

Many slides were shown of the dam, flood gates, turbines, and plant operation which illustrated the unusual service conditions imposed upon metals. Mr. Hess concluded his presentation by stating that no matter how well a product has performed under certain conditions, its use cannot be extended without the most careful consideration, for the slightest change greatly alters the serviceability of the product.

Stewart With Mouldings, Inc.

Robert A. Stewart, formerly vice-chairman of the North Texas Chapter ⊜, is now employed by Mouldings, Inc., Indianapolis, in the engineering department. He will be in charge of the plating department as well, as soon as the proper equipment can be installed.

Puzzled? . .

For a helpful answer to a question regarding the heat treatment of metal, call B-M Heat Treating Company and speak with one of our metallurgists.

They know most of the answers . . . Know where to find those that are somewhat off the beaten track.

No obligation, of course.

B-M Heat Treating offers you:

- ☐ Induction hardening
- ☐ Stabilizing
- ☐ Gas carburizing
- ☐ Ammanilding
- ☐ Isothermal treatments
- ☐ Dry Cyaniding
- ☐ Mirror finish
- ☐ Sub-Zero treatment
- ☐ Production and Tool Work
- ☐ Annealing and Stress Relieving
- ☐ Tensile Testing
- ☐ Sand Blasting

B-M HEAT TREATING COMPANY

220 Clifford Street
NEWARK 5, NEW JERSEY

Market 3-6400 Rector 2-2732

panding mandrel permits quick work changes. Different drillrods set correct tapers. Drillrod tool cuts ball ends on knobs and links. Altered tube fittings meet the deadline. Heavy-duty layout cube combines angle plate and V-blocks. Lower your hacksaw grip for better cutting. Old rag stops chatter in countersink milling. How to square fractions. Large bushings sensitively installed in close quarters. How to measure the radius of a short circular arc.

20-536. Gear Shaving. Part II. *Automobile Engineer*, v. 36, Nov. '46, p. 481-486.

Various types of gear shaving machines manufactured by the National Broach and Machine Co. and the Michigan Tool Co., Detroit. Methods of operation and the machine capacities. Details of gear shaving practice employed by Ford Motor Co., Ltd., Dagenham. Reasons for adopting gear shaving as a finishing process; speeds, feeds and production rates for typical gears; reference to the cutting fluids used and the heat treatment employed.

20-537. Toolmaking Methods and Calculations. *Machinery (London)*, v. 69, Nov. 14, '46, p. 625-629.

Depth gage for formed hole; tapered gap gage; fixture for timing gear; form gage for three blended radii; uses of the light box; checking splined work.

20-538. Helical Cutters With Adjustable Blades. C. F. Smith. *Machinery (London)*, v. 69, Nov. 14, '46, p. 633.

Helical cutter with blades that can be adjusted to permit regrinding or sharpening to the original diameter.

20-539. Production of Flat Surfaces. R. J. M. Whibley. *Machinery (London)*, v. 69, Nov. 14, '46, p. 634-639.

Preparation of samples produced by planing, vertical milling, negative-rake milling, toolroom surface grinding and surface broaching.

For additional annotations indexed in other sections, see:

7-383-393-398; 12-195-200-203; 13-44; 17-58; 19-320; 23-352; 24-196-215-216-217; 25-134; 27-180-185.

21 LUBRICATION and Friction; Bearings

21-105. Aluminum Bearings for Caterpillar Engines. George B. Grim. *Automotive and Aviation Industries*, v. 95, Nov. 1, '46, p. 28-29, 86.

Brief account of investigations carried out by Caterpillar Tractor to determine relative merits of various materials and several available bearing metal combinations under various conditions of load, temperature, and oil condition.

21-106. Metallic Bearings. H. L. Smith. *Iron and Steel Engineer*, v. 23, Nov. '46, p. 73-76.

Extensive and detailed answers to A.I.S.E. questionnaire on bearing design and usage.

21-107. The Influence of Composition on the Adhesion of Tin-Base Bearing Alloys to Steel. P. C. Forrester and L. T. Greenfield. *Journal of the Institute of Metals*, v. 73, Oct. '46, p. 91-104.

Investigation made to examine whether a bond equal to, or exceeding, the strength of the white metal is obtainable between all the alloys and basis materials tested in conditions analogous to those of practice, using the range of tin-base alloys in commercial use.

21-108. Lubricating Hot Strip Mills. A. F. Brewer and W. H. Mandy. *Steel*, v. 119, Dec. 9, '46, p. 90-93, 154, 156.

Increased speed of hot strip mills currently emphasizes the importance of lubrication under high temperature and water and scale contamination conditions. Proper types of grease and oil for roller bearings, screwdowns, couplings, pinions, gears, coilers and other machinery.

21-109. Bearing Selection Guided by Relative Material Merits. R. A. Watson and W. E. Thill. *S.A.E. Journal*, v. 54, Dec. '46, p. 41-46.

Compares the performance of present-day bearing alloys, and offers both engineer and engine operator a practical tool to rational choice of the right bearing for the job.

21-110. The Strip Steel Mill. *Lubrication*, v. 32, Sept. '46, p. 101-112.

Problem of lubricating under high temperature, high speed, water and scale-contamination conditions. Pertains particularly to the work roll bearings and back-up roll bearings, and indirectly to the screwdown drives, the universal couplings, pinion stands and reduction gears, the table roll bearings and the coiler.

21-111. How Special Blending Improves Cutting Fluids. James T. Beard, Jr. *Machinery*, v. 53, Dec. '46, p. 156-160.

Tests prove effectiveness of adding sulphur, chlorine, oiliness agents, and other compounds to cutting fluids for machining various steels.

21-112. Lubricating Hot Strip Mills. A. F. Brewer and W. H. Mandy. *Steel*, v. 119, Dec. 16, '46, p. 94-96, 140.

Planning lubricating system.

For additional annotations indexed in other sections, see:

8-159; 20-532; 24-202-203.

22 WELDING Flame Cutting; Riveting

22-559. Welding, Flame Cutting for Efficient Maintenance and Low Cost. A. D. Stout, Jr. *Coal Age*, v. 51, Nov. '46, p. 100-104.

Applications in the maintenance of transportation equipment, including track, cars and locomotives.

22-560. Spot Welding Technique for Primary Structures. Part II. Frederick S. Dever. *Aviation*, v. 45, Nov. '46, p. 64-65.

Important operational factors pertinent to equipment; Army and Navy weld specifications; inspection procedures.

22-561. Resistance Welding of Stainless Steels—2. J. J. Riley. *American Machinist*, v. 90, Nov. 21, '46, p. 108-112.

Seam welding variables.

22-562. The Welding of Light Alloys. *Metallurgia*, v. 34, Oct. '46, p. 321-324.

Welding of aluminum-magnesium alloys; aluminum alloys for gas welding with special reference to aluminum-silicon-copper alloys; pressure welding of light alloys without fusion; examination of light alloy flash welds made by a Swedish company; industrial practice for spot welding; present trends in American machine design; technique for the gas welding of magnesium alloys; the tensile strength of gas welds in manganese alloy to specification D.T.D. 118.

22-563. Layouts for Machine Gas Cutting Made With Wrapping Paper. Elmer Kappel. *Materials & Methods*, v. 24, Nov. '46, p. 1229.

Substitution of ordinary wrapping paper for a plate of sheet iron.

22-564. Industry Embraces Weldments. Edwin Laird Cady. *Scientific American*, v. 175, Dec. '46, p. 245-248.

Full advantage can be taken of all-metal fabrication methods and of desirable characteristics of metals themselves. Weldments reduce the need for complicated castings and intricate machining.

22-565. Het Solderen Van Aluminiumhoudende Zinklegeringen. (How to Solder Aluminum-Containing Zinc Alloys.) F. K. T. Beukema Toe Water and H. C. J. De Decker. *Metalen*, v. 1, Oct. 15, '46, p. 23-27.

Results of investigation performed in the Central Material Research Institute of Delft (Holland) showed that zinc alloys containing aluminum up to 0.7% may be successfully soldered either by special soft cadmium-containing solder using an active zinc-ammonium chloride flux, or by common soft tin-lead solder using a nominal flux after the alloy has been coated with zinc. Zinc alloys containing up to 4% Al may be soldered with any soft solder using a common flux, but only after the alloy has been coated with a galvanic zinc layer.

22-566. Resistance Welding With Storage-Battery Power. John D. Gordon. *Welding Journal*, v. 25, Nov. '46, p. 1049-1054.

Construction and operation of this type of welding equipment, which permits resistance welding of aluminum and its alloys at lower cost and in areas removed from high-capacity power lines.

22-567. Additional Timing Period of New Motor-Driven Control Increases Gun Welder Speed. H. I. Stanback. *Welding Journal*, v. 25, Nov. '46, p. 1055-1060.

Requirements and problems in resistance spot welding at high production rates. Development and operation of a new high-speed sequence weld timer using cam-operated contacts driven by a synchronous motor.

22-568. Design and Production Control of Silver Alloy Brazed Joints in Aircraft Structures. H. A. Smith and P. A. Koerner. *Welding Journal*, v. 25, Nov. '46, p. 1061-1067.

Preliminary survey of design and fabrication methods. Constant and variable factors in design of such joints; rules for preparation and assembly, heating, cooling, and defluxing; rules for certification of operators.

22-569. Oxy-Acetylene Pressure Welding of Some Low-Alloy Steels and Nonferrous Alloys. Kenneth H. Koopman. *Welding Journal*, v. 25, Nov. '46, p. 1069-1076.

Data collected in the course of development of procedures for pressure welding various steels and nonferrous alloys. Description of tests of pressure welds made in the following steels: S.A.E. X4130; 0.28% C, 1.60% Mn, 0.43% Mo steel; N.E.8740; N.E.8630; N.E.8620; 5% Cr, 0.50% Mo steel; carbon-silicon spring steel. Tests of pressure welds in the following nonferrous alloys: nichrome (80% Ni, 20% Cr); monel; everdur; aluminum-iron bronzes; tobin bronze. 11 ref.

22-570. Control of Welding Stresses by Welding Sequence. Paul Ffield. *Welding Journal*, v. 25, Nov. '46, p. 1109-1122.

Details of Bethlehem Steel's research on determination of the characteristic pattern of stresses in welded ships and on the possibilities of making these stresses contribute to rather than detract from the strength of the structure. Stresses determined, using a model, agreed quite well in most cases with those determined on a Destroyer Escort. Recommendations are given for welding sequence to develop desired stress patterns.

22-571. A Method for Determining the Applicable Welding Procedure for Steels. Bela Ronay. *Welding Journal*, v. 25, Nov. '46, p. 736s-747s.

New method utilizes high-frequency heating to confine a large energy input to a relatively small volume, thereby simulating the heat concentration obtained in arc welding, and avoiding

(Turn to page 40)

New Concept of Carbon Pickup Is Presented

Reported by R. C. Hendrickson
Metallurgist
Bausch and Lomb Optical Co.

A new concept of the heat treatment of high speed steel was learned by members of the Rochester Chapter ⊖ at the November meeting when W. A. Schlegel of the Carpenter Steel Co. presented the results of his exhaustive investigations into the effects of furnace atmospheres on the carburization and decarburization of 18-4-1 high speed steel during hardening. Contrary to general belief, Mr. Schlegel pointed out, there is a much greater tendency to pick up carbon than there is to lose it under normal hardening conditions even when the furnace atmosphere is slightly oxidizing.

In support of his statement Mr. Schlegel presented the results of surface carbon analyses and photomicrographs showing the degree of carbon penetration. Carbon pickup was found especially serious in blind holes where it occurred in sufficient extent to cause melting in many instances.

The coffee talk was presented by Col. J. H. Belknap, newly appointed head of the department of engineering of the University of Rochester. Colonel Belknap described his activities as chief of the engineering and optics section of the U. S. Office of Military Government for Germany.

Bulk of Railroad Failures Caused by Faulty Design or Poor Quality Material

Charles B. Bryant Addressing the Calumet Chapter on Railroad Failures

Reported by Glenn D. Boyer
La Salle Steel Co.

Charles B. Bryant, chief engineer for the Technical Board of the Wrought Steel Wheel Industries, talked to the Calumet Chapter ⊖ on Nov. 12 about railroad failures. Mr. Bryant's years of experience as engineer of tests for the Southern Railway stood him in good stead as he discussed informally those failures resulting from accidents, from deficiency of materials, or from manufacturing irregularities or defects.

The first two classes are relatively infrequent. While accidents do cause breakage or other failure of equipment, and at times inadequate materials may be specified, the great bulk of railroad failures, according to Mr. Bryant, are due to manufacturing causes. These may be attributed to faulty design or poor quality of material. Poor execution of work in the machine shop and conditions of use are other causes.

Mr. Bryant spoke of the amount of work being done both by the railroads and their suppliers in studying and correcting these failures. Examples are controlled cooling for the elimination of shatter cracks, and the current work being done on rail shelling.

BETTER HEAT TREATING
AT REDUCED COST
by Improved Thermocouples

Save Time

New #2150 HEAD PERMITS *QUICK INSPECTION* OF THERMOCOUPLE *WITHOUT DISCONNECTING LEADS* —no possibility of wrong reconnection—no interruption of production. Thermocouple wires enter connector without bending and are easily replaced by loosening two screws. Ceramic connector body withstands high temperatures.

Closer Temperature Control

80% Nickel, 13% Chromium seamless drawn INCONEL protecting tube fits thermocouple closely for maximum sensitivity.

Long Life

Heavy .147" wall thickness, and absence of porosity, assures long life—ductility eliminates breakage.

Recommended for all general heat treating service except sulphurous atmospheres.

No Other Thermocouple Has All These Features

ARKLAY S. RICHARDS CO., Inc.
Incorporated 1938
Office and Factory: 86 Winchester Street, Newton Highlands 61, Mass.
Thermocouples Thermocouple Wire Thermocouple Lead Wire
Protecting Tubes Insulators Terminal Heads & Connectors
Prompt Shipment From Stock on Everything for the Pyrometer User.
Send for Catalog No. 4 Describing Complete Line With Prices and Recommendations

CHEMICALS ACP PROCESSES

Surface Treating Chemicals

PROTECT METALS BY

- *Removing Rust, Oil and Grease*
- *Providing Improved Paint Adhesion*
- *Preventing Rust*
- *Inhibiting Pickling Acids*

Bulletin P-100-21, a concise guide to ACP surface treating chemicals and metal protective service, will be sent on request.

AMERICAN CHEMICAL PAINT CO.
AMBLER, PENNSYLVANIA

"Pioneering Research in Metal Preservation Since 1914"

various drawbacks of other methods. Extensive details of the equipment, method, and results of application to six high-tensile steels are given. Also describes notch-bend test using plungers of graduated radii to evaluate the notch sensitivity of each heat or shipment of steel.

22-572. Arc Atmospheres and Underbead Cracking. Manley W. Mallett and Perry J. Rieppel. *Welding Journal*, v. 25, Nov. '46, p. 748s-759s.

Experimental methods used and results obtained in an investigation of arc-atmosphere compositions and their relation to underbead cracking of hardenable alloy steels; synthetic arc atmospheres and underbead cracking; changes in composition of synthetic arc atmospheres on passing through a metal arc; hydrogen and underbead cracking. An atmosphere of equal parts CO and CO_2 gave good arc characteristics, no underbead cracking or porosity and, in general, a better welding arc than any other combination of gases used.

22-573. The Control of Weld Hot Cracking in Nickel-Chromium-Iron Alloys. T. E. Kihlgren and C. E. Lacy. *Welding Journal*, v. 24, Nov. '46, p. 769s-775s.

Study of weld hot cracking encountered in the manual arc welding of nickel-chromium-iron alloys containing 25 to 80% of nickel and 15 to 20% of chromium indicates that silicon causes weld hot cracking in these alloys and that introduction of columbium into the fusion counteracts the effect of silicon. When Cb to Si ratio in the weld metal exceeds a minimum value, which varies from alloy to alloy, uncracked welds can be consistently obtained.

22-574. The Weldability of Ship Steels. Ernest F. Nippes and Warren F. Savage. *Welding Journal*, v. 25, Nov. '46, p. 776s-787s.

A study of the effects of travel speed, preheat temperature and arc power level on the notch toughness of weld metal and heat-affected zone.

22-575. Some Observations on the Weldability of High-Strength Wrought Aluminum Alloys. William R. Apblett, Jr. *Welding Journal*, v. 25, Nov. '46, p. 802s-808s.

Tensile and slow bend tests indicate strength of 61S-T, 24S-T and 75S-T alloys is not utilized to the full extent because of present-day electrodes and the deleterious effect of welding on wrought aluminum alloys. Recommends future work on development of electrodes which will produce better mechanical properties in the deposited weld metal and development of more weldable aluminum alloys.

22-576. Automatic Welder Embodies New Principle. *Iron Age*, v. 158, Nov. 28, '46, p. 67.

Development of automatic multispot resistance welding machines. In addition to high speed of operation, an outstanding advantage is that the various welding guns can weld different thicknesses of metal requiring variable welding times, heats and speeds.

22-577. The Theory of Moving Sources of Heat and Its Application to Metal Treatments. D. Rosenthal. *Transactions of the American Society of Mechanical Engineers*, v. 68, Nov. '46, p. 849-865; discussion, p. 865-866.

Outlines the fundamentals of this theory and derives appropriate solutions for linear, two and three-dimensional flow of heat in solids of infinite size or bounded by planes. Point, linear, and plane sources of heat are examined. Solutions obtained are applied to welding problems. These solutions are in good agreement with the experimental results and permit close analysis of the factors governing heat flow in welding. Formula for predicting time and rate of cooling with fairly good accuracy for a wide variety of thicknesses of steel is derived. Shows how this theory could be applied to other problems in metal treatment. 20 ref.

22-578. Characteristics of Welding Arcs on Aluminum in Atmospheres of Helium and Argon. F. A. Wassell. *Aluminium and the Non-Ferrous Review*, v. 2, July-Sept. '46, p. 66-70.

An investigation based on the principle of gas-shielded arc welding, utilizing inert gases such as helium and argon for the purpose of developing a process which would eliminate the use of flux in the welding of aluminum.

22-579. Reducing Welding Cost With Jigs. *Sheet Metal Worker*, v. 37, Nov. '46, p. 33-35.

Assembly and holding fixtures for faster, better work, utilization of less skilled mechanics, and time saving.

22-580. Oxygen-Arc Cutting. *Steel*, v. 119, Dec. 2, '46, p. 116, 118.

In combining a stream of oxygen with the arc by means of a tubular electrode, a cutting temperature is obtained that is 3000° hotter than that usually realized with common cutting methods. Process has been used to cut a variety of metals occurring in the form of sheets, plates and castings, as well as to cut metals in any shape and under various conditions.

22-581. Influence of Magnetic Materials on the Welding Characteristics of Resistance Welding Machines. J. J. Riley and C. E. Smith. *Electrical Engineering Transactions*, v. 65, Nov. '46, p. 852-860.

Introduction of magnetic material into the throat of such equipment causes a reduction of the welding current. Effects on welding current produced by changing sheet thickness and width, length inserted, position, and current used for welding. Results are charted and tabulated, and application to practical problems illustrated by sample calculations.

22-582. The Welding of Nonferrous Metals. (Continued.) Part VIII. E. G. West. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2183-2188.

Oxy-acetylene welding of copper and its alloys. (To be continued.)

22-583. Resistance Welding of Stainless Steels. Part 3. J. J. Riley. *American Machinist*, v. 90, Dec. 5, '46, p. 134-138.

Advantages of flash welding are high speed, little or no preparation of parts for welding, close tolerances of finished product, and physical properties more similar to the parent metal than welds made by any other process. Applications are primarily restricted to butt joints and particularly those in which the weld components are of equal size as well as symmetrical in shape and cross-sectional area.

22-584. Welding in the Home. C. F. Block. *Welding Engineer*, v. 31, Dec. '46, p. 39-42.

New home construction offers steel cabinets for bedroom, basement and kitchen, enameled steel shower stalls, stainless steel wash basins and toilets, prefabricated steel staircases, steel tiles and panels, steel structural members.

22-585. Furnace-Brazed Steel Parts. J. E. Jevons. *Welding Engineer*, v. 31, Dec. '46, p. 47-49.

First successful use; continuous furnaces; types of atmospheres; times and temperatures; causes of failure; strength of joints; suggested applications; batch brazing.

22-586. Effects of Current Shunting on Spot Welds. Julius Heuschkel. *Welding Engineer*, v. 31, Dec. '46, p. 55-57.

Test results re-emphasize the possible significance of permitting the production use of uncompensated current shunting. Data were obtained from welds and joints in ¼-in. plain carbon steel. The seven specimens shown were all made within the same time interval with the same force on the same machine, using the different heat control settings that are listed. All welds were made with a single impulse of 60 cycles (1 sec.) duration. All of the specimens were 5 in. wide.

22-587. Welding German U-Boats. *Welding Engineer*, v. 31, Dec. '46, p. 61-62.

Methods and welding sequences used at a German shipyard to build the late type XXI U-boats. Prefabricated sections were employed, and eight welders worked at once on a circumferential seam.

22-588. Soldering and Brazing of Stainless Steel Piping. Eric R. Seabloom. *Welding Engineer*, v. 31, Dec. '46, p. 63-66.

What solders, brazing alloys and fluxes to use to join stainless tubing and fittings. Techniques of making capillary soldered and brazed joints on stainless alloys.

22-589. Welding. *Russian Technical Research News*, v. 1, no. 4, '46, p. 1.

Russians challenge J. M. Keir's (Linde Air Products) theory that finer-grained flux gives a wider bead. Experiments gave opposite results. Also found that arc-potentials rise with grain size and that amount of flux consumed per unit of time increases with grain size and with speed of welding. Describes small portable electric welder. (Abstracted from *Autogennoye Delo*, no. 1, 1946.)

22-590. What Changes to Improve Welding Codes and Specification? *Product Engineering*, v. 17, Dec. '46, p. 81-84.

Criticisms and suggestions are presented with the hope that they may stimulate interest and action toward the preparation of better specifications.

22-591. Contact Arc Welding. P. C. Van Der Willigen. *Iron Age*, v. 158, Dec. 12, '46, p. 58-62.

New welding technique employs special electrodes in which more than 50% of the weld metal is contained in the coating. Process may be used by entirely unskilled workers since the end of the electrode is held in contact with the work at all times and merely drawn along the surface. Contrasts current European welding practice with American methods.

22-592. Wood-To-Metal Adhesives. Thomas D. Perry. *Mechanical Engineering*, v. 68, Dec. '46, p. 1035-1040.

Some practical applications; fundamentals of adhesion; origin of metal-to-wood gluing; methods of metal-to-wood gluing; metal-to-wood applications; nonplywood applications.

22-593. Welding Fixtures for Mass Production. A. E. Rylander. *Tool Engineer*, v. 17, Dec. '46, p. 21-27.

Simple fixtures and straightline flow of materials result in ease of operation and a very high production potential.

22-594. Fixtures Make Welders Flexible. Part I. Ed Reilly. *American Machinist*, v. 90, Dec. 19, '46, p. 104-107.

Examples of current setups over a range of commercial items.

22-595. Powder Metal Welding Rods. F. C. Kelley and F. E. Fisher. *Iron Age*, v. 158, Dec. 19, '46, p. 68-72.

Method of producing 18-8 welding rods by extruding a powdered metal mixture, which results in a rod having very satisfactory welding characteristics. The metal is deposited in the form of a fine spray. Technique described for the first time.

(Turn to page 42)

LATEST NEWS ON RESISTANCE WELDING
can be found each month in the WELDING PICTORIAL. Ask to be put on the mailing list.
Progressive Welder Co. Detroit 12, Mich.

Tells of Die Casting Inventions, Practice for Various Alloys

Reported by Wes Hammond
Laboratory Director
San Francisco Naval Shipyard

Die castings have the great advantage of eliminating machine work, taking the place of several fabricated parts, and allowing for complex design, such as for internal gears and D-shaped holes, H. L. "Red" Harvill, president of H. L. Harvill Mfg. Co., Corona, Calif., declared in a talk on "Die Casting—Materials, Methods and Machines" before the Golden Gate Chapter ⓖ. Though die cost is high, he said, the unit cost of such castings is low.

After discussing his inventions in hot-chamber die casting, Mr. Harvill related some experiences in casting various alloys. Aluminum die casting is on the increase, he declared, with the 10% silicon alloy the best in the group; the silicon-copper type with 7% silicon is also adequate.

Magnesium alloys are actually easier to die cast than aluminum, according to the speaker. The best one contains 8% Al, 0.5% Zn, 0.5% Si and a small amount of manganese. In the yellow metals group, he recommended manganese bronze, with 0.18 to 0.25% Mn (to keep the dies clean), and yellow brass. He also had a good word for "Zamak" alloy in the zinc-base group, but warned against contamination by lead, tin or cadmium if grain growth and trouble are to be avoided in making zinc die castings.

Mr. Harvill furnished concrete figures on pressure requirements and other details of the die-casting business, either during his main talk or in the extended open discussion which followed. Pressures should be 1000 psi. for zinc, 3500 psi. for magnesium and aluminum, and 11,000 psi. for brass and bronze in order to prevent zinc vaporization.

Dross losses will run about 1% for zinc castings, 15% for bronze, 5% for aluminum, and 35% for magnesium. A long die life can be expected for zinc work, an erratic life of 50,000 to 150,000 shots for aluminum, 1,000 to 25,000 shots for brass, and 75,000 to 150,000 shots for magnesium.

Particularly interesting were some manufacturing details elicited in response to questions fired at the speaker. He recommended dimensional stabilization of aluminum die castings by soaking at 500 to 550° F. for 4 to 5 hr. This treatment would also tend to prevent corrosion at highly stressed areas. One of the unrealized advantages of die castings, as compared to those formed in sand, is the high physical strength given by the rapid change from the liquid to the solid phase, inherent in the process.

Steels for dies must be selected and heat treated with great care; stainless steel gives little advantage. Successful die lubricants are graphite mixed with various oils, colloidal graphite mixed with kerosene, plain graphite for aluminum, and cocoa butter for zinc. In die casting brass and bronze, experience has proved that the steel die should be raised and kept at practically a red heat.

Plomb Tool Co. Visited

Reported by H. L. Millar
Assistant Metallurgist
Plomb Tool Co.

Plomb Tool Co. was host for the third field trip of Los Angeles Chapter's educational program on Dec. 5. With the plant in full operation, the visitors were able to witness the various steps in manufacture of hand service tools; judging from interest shown, hot forming operations were most spectacular.

At the conclusion of the trip the group returned to the clubhouse and engaged in an informal round-table discussion.

*Consider the fastener!
More and more Engineers are recognizing its true importance!

WATER COOLER. Here, front cover of a water cooler is hooked at the top and pre-attached SPEED NUTS snapped over the base frame to lock panel securely. Removal for service is equally simple.
COOLERANT TUBES. Coolerant tubes are installed quickly and securely with SPEED NUTS. Studs are welded in place, tubes positioned and SPEED NUTS zipped over studs into locked position.

Engineers, who perform seeming miracles every day, are fast becoming fastener conscious. For, with improved fasteners, assembly is made faster and less costly. Fewer parts are used. Weight is reduced. And—that old bugaboo, "vibration loosening" is licked.

Today, SPEED NUTS open the door to design possibilities never before fully explored. Above are shown but a few of over 4000 SPEED NUTS available. Possibly they will give you an idea of what can be done to secure better fastenings for your products.

We would like to help you. Why not write us today.

TINNERMAN PRODUCTS, INC. • 2026 Fulton Road • Cleveland 13, Ohio

Speed Nuts
MORE THAN 4000 SHAPES AND SIZES
FASTEST THING IN FASTENINGS

Resistance Welding News

NEW COST-CUTTERS

Free information on new ways of lowering production costs, improving design and increasing output on metal products from automobile fenders to DDT 'bombs'; from metal cabinets to oil tanks; from outdoor advertising signs to refrigerators; from toy wagon wheels to complete stainless steel truck-trailers; from bearing cups to mercury switch bulbs; mild steel door frames and aluminum window sash; stoves, hoods, wrenches, smoking pipes . . . or what have you. You'll find the case histories from month to month in the oldest exclusive resistance welding publication—the WELDING PICTORIAL, published by Progressive Welder Company, now the world's largest producer of resistance welding equipment. *Write for it today on your company letterhead.*

If you have an immediate problem on re-design, Progressive's Process Engineering Department can help you prove to yourself that:

"IT PAYS TO WELD—PROGRESSIVE"

IT PAYS TO WELD
PROGRESSIVE Welder Co 3050 E. OUTER DRIVE • DETROIT 12
RESISTANCE WELDING EQUIPMENT

22-596. Welding With Complex Aluminum Bronze Electrodes. F. C. Evans and G. Haim. *Welding*, v. 14, Nov. '46, p. 501-510.

Development of complex aluminum-bronze electrodes and properties of the weld deposits. Welding technique and practical applications.

22-597. Oxygen Cutting. Part V. Manual and Machine Methods. E. Seymour Semper. *Welding*, v. 14, Nov. '46, p. 520-526.

Latest type of equipment and technique, and appropriate operating data.

For additional annotations indexed in other sections, see:

7-365-397-399; **9**-143; **20**-520; **23**-339-340; **24**-197-198-199-210; **27**-180.

23 INDUSTRIAL USES and Applications

23-331. Facts and Fallacies of Lead Exposure. Felix Edgar Wormser. *Paint and Varnish Production Manager*, v. 26, Nov. '46, p. 291, 293-299.

Certain "fallacies" concerning the toxicity of lead and its compounds as encountered in diverse commercial products.

23-332. Ferritic Disks for Gas Turbines. D. A. Oliver and G. T. Harris. *Metallurgia*, v. 34, Oct. '46, p. 293-294.

Four brands of steel of ferritic type have been developed for gas turbines; their properties; manufacture of turbine disks from these steels.

23-333. Recent Developments in Materials for Gas Turbines. *Metallurgia*, v. 34, Oct. '46, p. 316-320.

Materials for turbine blades; turbine disks; turbine nozzle assembly; combustion chambers; compressors. (Summary of symposium presented before Institution of Mechanical Engineers.)

23-334. Minerals and Chemical and Allied Industries. Part III. A Review of Sources, Uses and Specifications. *Industrial Chemist*, v. 22, Oct. '46, p. 573-578.

In this series of articles detailed consideration is given to such minerals as can be used in those industries more or less in the form in which they can be produced by mining and dressing. This installment covers bentonite, beryllium, bismuth, bitumen, boric acid and borates, bromine, and cadmium. (To be continued.)

23-335. American Research on Germanium. William Bull. *Chemical Age*, v. 40, Nov. 2, '46, p. 531-533.

Work of Battelle Memorial Institute and Eagle-Picher Lead Co. in method of production on larger scale for important commercial uses. Film deposition methods; alloy systems.

23-336. Alloy S-816—The Jet and Turbine Steel. Thomas Y. Wilson. *Steel Processing*, v. 32, Nov. '46, p. 707-709, 723.

Chemical composition; structure; method of testing; heat treatment; fabrication; and applications.

23-337. Modern Armor Plate. H. R. Clauser. *Army Ordnance*, v. 31, Nov-Dec. '46, p. 252-253.

Techniques of production.

23-338. I. C. Builds Aluminum Refrigerator. *Railway Age*, v. 121, Nov. 23, '46, p. 875-879.

Design and construction of experimental refrigerator car built for Illinois Central.

23-339. Welded Freight Car Construction. R. L. Rex. *Welding Journal*, v. 25, Nov. '46, p. 1043-1048.

Results of survey of current trends in welded freight car construction.

23-340. The Development of High-Strength Welding Quality Alloy Steels and Their Postwar Applications. Howard Miller. *Welding Journal*, v. 25, Nov. '46, p. 1077-1079.

Wartime development of high-strength welding quality steel for gun carriages and subsequent application to end underframing of railroad passenger cars.

23-341. Magnesium in Photo-Engraving. H. E. Swayze. *Photo-Engravers Bulletin*, v. 36, Nov. '46, p. 53-63.

History and production; recovery from the sea; magnesium alloys; magnesium as an engraver's metal; characteristics of magnesium in photo-engraving.

23-342. Directory of Materials for the Construction of Chemical Equipment. *Chemical Engineering*, v. 53, Nov. '46, p. 110-119.

Nearly 600 items are arranged alphabetically within each of seven classes. Included are: manufacturer, essential nominal chemical composition, forms available, and primary uses.

23-343. "Radiators"—an Interesting Example of Presswork. P. D. Aird. *Modern Industrial Press*, v. 8, Nov. '46, p. 13-14, 16, 20, 26.

Parts produced for assembly are manufactured from four basic metals, lead, copper, brass and steel. Four types of radiators make up the bulk of the production. Describes and illustrates procedures and equipment.

23-344. Aluminum Span for E-60 Railroad Bridge. *Engineering News Record*, v. 137, Nov. 28, '46, p. 52-54.

What probably is the first all-aluminum span to carry railroad traffic has been installed as a deck plate girder in a bridge that has similar steel for comparison. Plates and shapes are high strength 14S-T alloy, while rivets, driven cold, are A17S-T.

23-345. Stainless-Clad Stampings Enter the Automotive Industry. *Steel Processing*, v. 32, Nov. '46, p. 710-711, 723.

In addition to the obvious advantages of much greater corrosion resistance of clad steel, cladding of 10 to 30% stainless commonly bonded to the mild steel backing insures greater resistance to chipping and to scars or scratches that would normally penetrate the usual chromium plating. Methods of production and some uses.

23-346. Modern Hard Magnetic Materials. K. Hoselitz. *Metal Treatment*, v. 13, Autumn '46, p. 213-222.

Development of efficient hard materials for permanent magnets; their influence on magnet design; aging stability characteristics.

23-347. Magnesium and Its Uses. L. G. White. *Canadian Metals & Metallurgical Industries*, v. 9, Nov. '46, p. 33-34, 47.

Methods of prefabrication, corrosion resistant properties, surface treatments, cathodic protection, fire hazard.

23-348. Stainless Steel Refrigerator Car. Ray E. DeCamp. *Western Machinery and Steel World*, v. 37, Nov. '46, p. 88-91, 104.

Stainless steel, with its high resistance to corrosion, has been used for the sheathing of Consolidated Steel Corp.'s experimental general-purpose refrigerator car for the Santa Fe, together with stainless-clad ends. Details of construction and fabrication.

23-349. Where to Use Low-Alloy, High-Strength Steels. Harry S. Wharen. *American Machinist*, v. 90, Dec. 5, '46, p. 108-111.

High strength, easy fabrication, excellent corrosion resistance make them especially desirable for mobile equipment and other structures where weight and life affect operating and service costs.

23-350. Very Thin Electrical Steel for High-Frequency Components. G. H. Cole. *Electrical Manufacturing*, v. 38, Dec. '46, p. 104-107, 190, 192, 194, 196, 198, 200.

Silicon steel, cold rolled into strip of thicknesses as small as 1 mil, has been found to be an entirely practical material for magnetic cores in circuits operating at frequencies up to 2 megacycles.

23-351. Aluminum and Magnesium in the Electrical Industries. (Continued.) B. J. Brajnikoff. *Light Metals*, v. 9, Nov. '46, p. 609-618.

Some modern developments of high-voltage generation, with particular reference to the high electrical efficiency afforded by the use of aluminum in the construction of electrical generators. (To be continued.)

23-352. Needle Production. *Machinery (London)*, v. 69, Nov. 21, '46, p. 651-656.

Separation and eye end grinding; scouring; plating; heading and inspection; hand heading.

23-353. Nonferrous Alloy Materials for Mechanical Springs. F. P. Zimmerli. *Product Engineering*, v. 17, Dec. '46, p. 85-87.

Physical and chemical properties of the commonly used nonferrous alloy spring materials are listed. Proper application and limitations of the materials under conditions requiring electrical conductivity, corrosion resistance, or resistance to loss of load at elevated temperatures.

23-354. Fabricating Aluminum Radiators. *Steel*, v. 119, Dec. 16, '46, p. 102.

Three novel machines developed by the Germans which may lead to manufacture of improved automobile and aircraft radiators.

23-355. Some Observations on German Cable Manufacture. R. A. Schatzel. *Wire and Wire Products*, v. 21, Dec. '46, p. 965-967, 980-985.

Observations made during recent inspection of German plants. Composite picture of the plant, the rod mill, the wiredrawing department. Manufacture of trolley wire; annealing; tinning; stranding; paper cable machines; drawing aluminum wire; magnet wire; impregnated paper cables; lead presses; rubber covering; insulating process; testing and repairs; taping; extrusion machines; braiding; mineral insulated cables.

23-356. How to Select and Treat Mold Steels. Ralph H. Hoensheid. *American Machinist*, v. 90, Dec. 19, '46, p. 130-132.

Hobbing materials; stainless steel molds; mold surface defects. Finish of plastics products will be only as good as the surface of the mold cavity. Defects from poor carburizing practice may offset steel selection and efficient polishing procedure. Materials are pure iron, alloy iron, toolsteels, and stainless steels, with some nonferrous alloys. Polishing and heat treating procedures given.

23-357. 1,500,000,000 Needles. *Machinery (London)*, v. 69, Nov. 14, '46, p. 615-624.

Processes of wiredrawing; cutting to length; pointing; skimming; stamping and eyeing; stamping tools.

23-358. Steel for Enameling. *Steel*, v. 119, Dec. 23, '46, p. 80.

Possibilities in substitution of mild steel for enameling stock during steel shortage. Lists items and types which should not be substituted, and recommends special procedures to be followed with the mild steel stock.

For additional annotations indexed in other sections, see:

2-161; **3**-249-258-259; **5**-74-75; **6**-138-139-140-142-149; **7**-368-374-380; **18**-269; **19**-303-313; **20**-507; **22**-559-584-587; **24**-197-206; **25**-128-135; **27**-176.

(Turn to page 44)

FREE COST-CUTTING IDEAS
Through resistance welding. Ask for the monthly WELDING PICTORIAL
Progressive Welder Co. Detroit 12, Mich.

Heat Flow and Quench Rates Affect Spot and Flash Welding

Reported by F. E. Hense
Assistant Chief Metallurgist
Buick Motor Division

The modern metallurgist's responsibility goes beyond the selection of materials and the heat treatment of the component parts. Where welded assemblies are concerned he often has responsibility in the quality of the final assembled product. This was pointed out in a talk given before the Saginaw Valley Chapter by Julius Heuschkel, research engineer, Westinghouse Research Laboratories, East Pittsburgh, Pa.

The technical paper was preceded by a coffee talk by Robert Russell, manager of the Wilcox Rich Division, Eaton Manufacturing Co., who traced the history and development of his company and its products from its start in 1913.

The first part of Mr. Heuschkel's talk was devoted to spot welding. The physical properties of the welded joints are affected by several factors, such as the chemical and physical properties of the materials to be joined, the thickness of the material, the design of the assembly with respect to stress concentrations, welding conditions, and any in-the-machine heat treatments employed.

The cooperation of the designing engineer, the metallurgist, and the control and welding machine producer with the welding engineer are required to assure that all conditions are properly met to make the most satisfactory welded products.

Slides were displayed showing the recrystallization pattern of the weld, the hardness patterns of the fusion and heat-affected zones, and microstructures of various portions of the weld resulting from the nonuniform quench rates. Ratio of tension to shear strength is used as an indication of weld quality, as is also angle of twist for spot welds.

Shorter welding times are used for thin sheets. The heated mass is small and this mass is close to the cooling electrodes, so that the quench rate is more rapid and a higher hardness may be obtained at the periphery of the spot weld nugget for steel of a given composition. Therefore, the thinner spot welded sheets should contain a lower carbon content. Where carbon cannot be kept sufficiently low it may be necessary to preheat the component parts or give an in-the-machine heat treatment after the welding operation —preferably a draw after the weld has cooled to form martensite.

When flash welding quench-sensitive materials, centering of the weld between the grips is very important for heat flow reasons, whether or not machine heat treatment is employed. Quench-sensitive steels can be satisfactorily flash welded by employing metallurgically proper techniques, Mr. Heuschkel pointed out.

In fusion welding, cooling rates, in general, decrease as piece thickness decreases—just the opposite of spot welding. A careless arc strike results in a rapid quench rate with the accompanying hardened zones and when welding higher carbon or other quench-sensitive steels this may cause reduction in the design factor of safety.

Since the factor of safety in a welded part may be reduced by stress concentrations, care should be taken to keep the zone of high stresses away from the point of maximum cooling rates unless the material used possesses properties which will withstand this combination.

Vascoloy-Ramet Names Agent

R. F. Hilbert has been appointed sales agent for the Vascoloy-Ramet Corp., manufacturers of cemented carbide and cast alloy cutting tools, in the Rochester, N. Y., area. Mr. Hilbert, previous to establishing his own business in 1945, spent 17 years in the machine tool industry as a sales representative.

Frohman Named General Sales Engineer for Ampco

O. Frohman

Oscar Frohman has been appointed general sales engineer for Ampco Metal, Inc., Milwaukee. Previously Mr. Frohman was manager of market development and will continue to carry out such work as is necessary in that capacity.

James Arter, who was general sales engineer, has been assigned the duties of assistant to the general manager.

New Lehigh Alumni Official

Long an active alumnus and worker for Lehigh University, S. T. Harleman has now been appointed to the permanent position of executive secretary of the Lehigh Council of Class Agents with offices on the campus.

After graduation from Lehigh in 1901, Mr. Harleman held various positions, including superintendent of the crucible steel department of Bethlehem Steel Co., association with Atlas Steel Corp., and sales engineer for the Titanium Alloy Mfg. Co. More recently he was eastern representative of the McLain Fire Brick Co.

PLEASE NOTE!

NAMES AND ADDRESSES of the magazines and journals annotated in the Review of Current Metal Literature are available in list form from ASM headquarters. Use this list if you wish to secure a copy of any original article, and write direct to the source. Copies of the address list may be secured free of charge by writing to Metals Review, 7301 Euclid Ave., Cleveland 3, O.

24 DESIGN

24-196. Designing Tools for Screw Machine Production. *Screw Machine Engineering*, v. 8, Nov. '46, p. 56-59.

Preventing objectionable rings when combining form and turning operations; form tool facing; combination tooling.

24-197. Field Erected Pressure Vessels. Fred L. Plummer. *Welding Journal*, v. 25, Nov. '46, p. 1081-1089.

Some of the factors which influence the economy and safety of large pressure vessels used for storage. Describes several cases of failures of such equipment and makes recommendations for future construction of such vessels. 13 ref.

24-198. Recent Trends in Concepts of Design for Welded Steel Structures. LaMotte Grover. *Welding Journal*, v. 25, Nov. '46, p. 1091-1108.

Effects of notches and other forms of stress-raisers shown by diagrams; Comparative freedom from failure of different ship designs. Effect of low temperatures on behavior of structural members is shown graphically. Also discusses influence of proportional limit, yield point and plastic deformation. Reviews results of box-girder tests at Bureau of Standards, drop-hammer flexural impact tests of rolled beams with butt-welded splices at Columbia, the behavior of steels subjected to repeated stress and the design of members and connections for fatigue loading as investigated by the Welding Research Council at University of Illinois.

24-199. Influence of Geometrical Restraint and Temperature on the Toughness and Mode of Rupture of Structural Steel. Arthur R. Anderson and Alvin G. Waggoner. *Welding Journal*, v. 25, Nov. '46, p. 789s-801s.

Attempts to approach problem from viewpoint of the design engineer. In Part I, behavior of ¼-in. medium structural steel plates under static tensions at temperatures ranging from +80 to −80° F. and geometrical restraints through the introduction of several patterns of welding were investigated. In Part II, a new type of test specimen for testing butt welds under biaxial tension is described and in Part III, behavior of the microstructure of the steel under uniaxial and biaxial tension at different temperatures is explained.

24-200. Determination and Presentation of Compressive Stress-Strain Data for Thin Sheet Metal. Walter Ramberg and James A. Miller. *Journal of the Aeronautical Sciences*, v. 13, Nov. '46, p. 569-580.

Various methods of obtaining the compressive stress-strain curve of thin sheet metal and their advantages and limitations. Presentation of stress-strain data in dimensionless form; advantages of such a presentation in correcting for the effect of variations in yield strength and in Young's modulus. Attention is called to a classification of stress-strain curves by shape factors following a three-parameter formula proposed by Osgood. 20 ref.

24-201. The Effect of Radius of Curvature and Preliminary Artificial Eccentricities on Buckling Loads of Curved Thin Aluminum Alloy Sheets for Monocoque Constructions. Georges Welter. *Journal of the Aeronautical Sciences*, v. 13, Nov. '46, p. 593-596, 604.

Sheets of aluminum alloy tested under special conditions offer highly increased buckling and ultimate strengths under compression loads. Local eccentricities of the curved panels, generally assumed to be exceedingly detrimental to the bearing capacity in compression, did not decrease the buckling load of the panels. Even holes produced by shooting bullets through the panels did not weaken materially their normal buckling strength or their ultimate resistance.

24-202. Development of Balanced Proportion Roller Bearings for Rolling Mills. Paul Haager. *Iron and Steel Engineer*, v. 23, Nov. '46, p. 62-72.

Experience and research have been combined in the evolution of improved bearing designs which have shown greater capacity and rigidity. Factors of larger necks, greater bearing capacity and improved fillets must be balanced by carefully selected mill roll characteristics.

24-203. Bearing Seals. L. G. Krug. *Iron and Steel Engineer*, v. 23, Nov. '46, p. 77-81; discussion, p. 82.

Materials for and design of bearing seals for steel mill machinery.

24-204. Forging Die Design. John Mueller. *Steel Processing*, v. 32, Nov. '46, p. 712-714.

Die design for forging automobile connecting rod.

24-205. Designing, Drafting and Using Press Tools. C. W. Hinman. *Steel Processing*, v. 32, Nov. '46, p. 724-729.

Diagrams show design of dies for cutting large steel blanks. Operations are described.

24-206. Vertical Sheet Construction Featured in New St. Petersburg Gas Holder. George C. Pfaff. *Gas Age*, v. 98, Nov. 28, '46, p. 25.

Design features of 2,000,000-cu. ft. all-welded gas holder which can withstand 100 miles per hr. wind velocity.

24-207. Some Experiments on the Distribution of Deflection and Stress in Thin Flat Plates. H. D. Conway and V. C. Davies. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2147-2151.

Circular plates loaded with a uniform pressure and supported at four points equidistant from the center, the position of the supports being varied in order to determine the effects. The problem of a uniformly loaded plate with a single central support is the special case met with when the four supports become coincident at the center. (To be continued.)

24-208. Patterns for Irregular Bodies of Unequal Taper. J. B. Clegg. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2165-2168.

Calculation of the design of above patterns of a particular type. Illustrated.

24-209. The Conversion of Sheet Steel to Cylindrical Forms. J. H. Mort. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2173-2174.

Some useful methods of calculation.

24-210. The Brittle Lacquer Method for Estimating Stress Distribution in Welded and Riveted Joints. R. F. Tylecote. *Sheet Metal Industries*, v. 23, Nov. '46, p. 2194-2198.

Specimens were made in 18-gage sheet aluminum alloy containing 3.5% magnesium (B.S.S.L. 46). Three types of specimen were used: first, a row of six welds; second, a row of four rivets, one with an overlap of ½ in., and another with an overlap of 1 in.; and third, a "mixed" joint consisting of four welds and three rivets, the rivets being placed one at each end and one in the middle.

24-211. Utilizing Mechanical Properties in Die Casting Design. Part IV. Members Subjected to Bending and Axial Loads. *Die Castings*, v. 4, Dec. '46, p. 25-26.

Strength of short members subjected to bending and axial loads; strength of columns subjected to concentric loads; strength of columns subjected to eccentric loads.

24-212. Experimental Stress Analysis Symposium. *Product Engineering*, v. 17, Dec. '46, p. 121-136.

Symposium of case histories wherein the application of experimental stress analysis resulted in design improvements. Brittle coating or Stresscoat technique; field of photo-elasticity.

24-213. High-Capacity Hydraulic Presses. E. A. Randich. *Machine Design*, v. 18, Dec. '46, p. 137-142.

Considerations and factors involved in design of hydraulic presses and auxiliary equipment.

24-214. Nomograph Aids Determination of Torsional Stresses in Shafts. Carl P. Nachrod. *Machine Design*, v. 18, Dec. '46, p. 157-158.

Two equations are given, one from which nomograph of five scales is made. Tells how to construct nomograph with use of both equations.

24-215. Hobbed Gear Tooth Layout Simplified. Part III. Clyde A. Young. *American Machinist*, v. 90, Dec. 19, '46, p. 133.

Additional values cover small numbers of teeth and amplify tables.

24-216. Interrupted Rotating Motion With Quick Take-Up Action. *Machinery (London)*, v. 69, Nov. 14, '46, p. 631-632.

Mechanism has purpose of transmitting motion to the gear from the shaft in such a manner as to have the rotary motion of the gear temporarily interrupted for a short, definite period followed by a quick take-up rotary motion which recovers the motion lost during the idle or interrupted period. Mechanism is incorporated in a machine that produces a woven-wire fabric.

24-217. Theory and Practice of Gear Generating. *Steel*, v. 119, Dec. 23, '46, p. 54-55, 101.

How to design gear teeth for maximum smoothness of transmitted motion.

For additional annotations indexed in other sections, see:

3-259; 9-143; 13-47; 22-568-570; 23-338; 27-181-183.

DESIGN for WELDING
For Latest News of Design and Methods to cut costs with resistance welding ask for the monthly WELDING PICTORIAL
Progressive Welder Co. Detroit 12, Mich.

25 MISCELLANEOUS

25-123. Review of Metal Literature. Emory C. Skarshaug. *Special Libraries*, v. 37, Nov. '46, p. 294-297.

Describes and comments critically upon A.S.M.'s "Review of Metal Literature", which is printed in the monthly *Metals Review*, and also compiled into an annual volume. Other indexing and abstracting publications, including Battelle's *Library Review*, are also described briefly.

25-124. Technological Progress Highlighted. *Steel*, v. 119, Nov. 25, '46, p. 38-40, 113, 114, 116, 119, 122, 124-125.

Digests of technical papers presented at November meeting of American Society for Metals.

25-125. A Symposium; Plant Layout and Material Handling. *Tool Engineer*, v. 17, Nov. '46, p. 18-26.

Fitting Factory Layout to the Product, by Andrew W. Kramer, Jr.—Procedure used in studying modest sized operations averaging about 100 direct workers per line of equipment. Plant Layout and Material Handling Studies, by Haylett B. Shaw—Costs reduced by development of equipment that reduces material handling; by employing properly qualified material handling engineers; by design of new buildings around operations; incentive standards.

(Turn to page 46)

New X-Ray Machine Uses High Voltages

Reported by James W. Haupt
Cardwell Mfg. Co., Inc.

Many interesting applications of X-ray were described and illustrated in lantern slides by E. Dale Trout, director, technical services, General Electric X-Ray Corp., Chicago, who spoke before the Wichita Chapter ASM on Nov. 14.

The first industrial applications of X-ray, he said, used medical apparatus —the only type then available. As the demand for X-ray in industry became greater, special equipment was designed to fit these needs. During the war the demand for X-ray equipment was increased greatly because of its use in detecting flaws in castings and welded structures in the aircraft and other industries.

Mr. Trout described briefly a new type of X-ray machine, built on an entirely different principle from the conventional machines, which allows the use of much higher voltages. One of the most recent applications he described was the examination of captured war equipment by the use of X-ray.

New Stainless Foundry Organized in Milwaukee

John McBroom *H. W. Kutchera*

Corrosion resistant stainless steel castings are the sole product of the new plant of the Stainless Foundry & Engineering Co., 5132 N. 35th Street, Milwaukee.

Partners in Stainless Foundry are two young graduate engineers and practical shopmen, John McBroom ASM and Harvey W. Kutchera. The former was graduated from the University of Minnesota in 1936 and joined the Duraloy Co., later engaging in electric furnace melting work and in his own consulting office in Chicago. Mr. Kutchera was graduated from University of Wisconsin in 1939, and has been associated with Kimberly-Clark, Chain Belt Co., product design at Waukesha Motor Co., and later was engaged in consulting engineering.

Heat Treating
Equipment Manufacturers

(Continued from Page 19)

K. H. Huppert Co. (R-132, R-133)
6830 Cottage Grove Ave., Chicago 37, Ill.

Industrial Chamberheat Laboratories
2103 Centre Street, (R-147)
West Roxbury, Mass.

Induction Heating Corp. (R-136, R-140, R-141)
389 Lafayette St., New York 3, N. Y.

Johnston Mfg. Co. (R-151)
2825 E. Hennepin Ave., Minneapolis 13, Minn.

Kali Manufacturing Co. (R-108)
427 Moyer St., Philadelphia 25, Pa.

Leeds & Northrup Co. (R-115)
4901 Stenton Ave., Philadelphia 44, Pa.

Lindberg Engineering Co. (R-123)
2444 W. Hubbard St., Chicago 12, Ill.

Link-Belt Co. (R-158, R-159)
307 N. Michigan Ave., Chicago 1, Ill.

Lithium Co. (R-120)
111 Sylvan Ave., Newark 4, N. J.

Mahr Mfg. Company (R-134)
1703 N. Second St., Minneapolis 11, Minn.

Metal Treating Institute (R-161)
420 Lexington Ave., New York 17, N. Y.

Metlab Co. (R-118)
1000 E. Mermaid Lane, Philadelphia 18, Pa.

Morrison Engineering Corp. (R-112)
5005 Euclid Ave., Cleveland, Ohio

Nitralloy Corp. (R-117)
230 Park Ave., New York City

North American Mfg. Co. (R-152)
2910 East 75th St., Cleveland, Ohio

Ohio Crankshaft Co. (R-135, R-137, R-138, R-139)
3800 Harvard Ave., Cleveland 1, Ohio

Park Chemical Co. (R-106, R-107)
8074 Military Ave., Detroit 4, Mich.

Pereny Equipment Co. (R-131)
Columbus 8, Ohio

Perfection Tool & Metal Treating Co.
1740 West Hubbard St., (R-116)
Chicago 22, Ill.

Radio Corp. of America (R-145)
Electronic Apparatus Section, Camden, N. J.

W. S. Rockwell Co. (R-125)
204 Eliot St., Fairfield, Conn.

Jos. T. Ryerson & Son, Inc. (R-160)
P. O. Box 8000-A, Chicago 80, Ill.

Sentry Co. (R-130)
Foxboro, Mass.

Sherman Industrial Electronics Co.
503 Washington Ave., (R-144)
Belleville, N. J.

Super-Treat, Inc. (R-156)
3412 Beekman St., Cincinnati 23, Ohio

Surface Combustion (R-114)
2375 Dorr St., Toledo 1, Ohio

Thermo Electric Mfg. Co. (R-129)
480 W. Locust St., Dubuque, Iowa

Upton Electric Furnace Div. (R-105)
7450 Melville at Green, Detroit, Mich.

Vapofier Corp. (R-150)
10316 S. Throop St., Chicago 43, Ill.

Edwin L. Wiegand Co. (R-127)
7500 Thomas Blvd., Pittsburgh 8, Pa.

MACHINING & MACHINE TOOLS

***Editorial Feature for* March Metals Review**

IN ITS continuing study of specific branches of the metal industry, Metals Review will bring into focus the new developments in the broad field of machining and machine tools in its March issue.

New cutting materials and lubricants, new tools and machines, accessories, etc. . . . all will be welcomed for editorial consideration.

Only requirement—your product must be new, definitely improved, or redesigned during the twelve months ending February, 1947.

Now is the time to act for participation in this important issue. Send in approximately 250 words and a glossy photograph, if available.

All material must be in our hands by February 10.

Metals Review

7301 Euclid Avenue **Cleveland 3, Ohio**

25-126. The Place of Research in the Iron and Steel Industry. *Engineering*, v. 162, Nov. 1, '46, p. 426-427.

Research organization of the British iron and steel industry.

25-127. Modernizing Malleable Iron Foundries. Fred A. Pampel. *Foundry*, v. 74, Dec. '46, p. 87-89, 226, 228, 230, 232.

Improved materials handling methods in the foundry.

25-128. Technology of Zirconium and Titanium and Their Compounds. Eugene Wainer. *Ceramic Age*, v. 48, Nov. '46, p. 198-201, 215-216.

Occurrence, beneficiation, preparation of derivatives, and commercial applications.

25-129. Flow Lines and Charts in Factory Planning. H. M. Harman. *Machinery (London)*, v. 69, Oct. 24, '46, p. 525-529.

Various flow charts and lines for different site and product conditions.

25-130. Improved Handling Repays Initial Cost in 10 Months. C. Lee Dryden. *Factory Management and Maintenance*, v. 104, Nov. '46, p. 112-115.

Four times the former output per man-hour is achieved through the installation of a conveyer system which moves heavy coils of steel strapping from slitter lines through wrapping operations to shipping platform or storage area. Savings the first year were $24,000.

25-131. Modern Material Handling Ideas for Cutting Tools. N. L. Davis. *Iron Age*, v. 158, Dec. 5, '46, p. 68-71.

Booster drives to lengthen chain life and eliminate edge damage in handling steel coils; rubber tread return rollers and higher belt speeds to improve ore handling methods; oscillating trough conveyers for rapid, economical handling of mill scale, machine shop scrap and foundry sands; internal bucket elevators for carrying small parts from a quench.

25-132. Metallurgy. *Russian Technical Research News*, v. 1, no. 4, '46, p. 3.

Russian developments in techniques for measuring microhardness applied to study of aluminum-copper and aluminum-silicon solid solutions; in composition of bessemer furnace charge for self-fluxing iron sinter; efforts to increase productive capacity of furnaces.

25-133. A User Looks at Hydraulics. H. T. Johnson. *Steel*, v. 119, Dec. 16, '46, p. 91, 113-114.

To improve design, installation and operation of equipment, there must be closer cooperation between the manufacturer of hydraulically operated or controlled equipment and his users. Several causes of misunderstanding and difficulties.

25-134. Ingenious Mechanisms. *Machinery*, v. 53, Dec. '46, p. 172-174.

Compact table-feeding mechanism; quarter-turn mechanism for transferring sheets from press to oven; an overload relief device for machine protection.

25-135. Fire-Fighting Trials on Magnesium-Base Alloys. *Engineering*, v. 162, Nov. 22, '46, p. 481-483, 492.

Magnesium, in several commercial forms, was ignited, and then the fires were put out using several methods. Results are used to recommend fire-fighting techniques and proper storage of magnesium, and to evaluate the risk involved in common applications of the metal.

25-136. Fisher Body Devises Aids for Pressed-Metal Handling. Rupert Le Grand. *American Machinist*, v. 90, Dec. 19, '46, p. 112-115.

Installations at Flint typify skill in development of mechanical substitutes for manual effort. Concerned mostly with mechanical handling aids that Fisher Body has designed and built for its own use.

25-137. Planning a Plant Layout. Robert Spurgin, Jr. *Iron Age*, v. 158, Dec. 19, '46, p. 73-75.

Practical procedures for small or large plant layout work.

25-138. "Merry-Go-Round" System. *Steel*, v. 119, Dec. 23, '46, p. 59.

Conveyer system used by Willys-Overland to feed jeep front ends to final assembly.

For additional annotations indexed in other sections, see:

11-104.

26 STATISTICS

26-75. Techniques of Soviet Iron and Steel Industry. I. Bardin. *Metallurgia*, v. 34, Oct. '46, p. 325-326.

Efforts being made to reconstruct the various plants, on the lines of a new five-year plan, which will incorporate more recent developments and enable prewar production to be greatly exceeded. General picture of reconstruction is given.

26-76. First Half 1947 Steel Demand Estimated at 29 Million Tons. Gene Hardy. *Iron Age*, v. 158, Nov. 21, '46, p. 106-108.

Civilian Production Administration steel demand estimates. Tonnage demands for carbon and alloy steel, and for pig iron, are broken down into requirements for individual items; for instance, washing machines. These figures are also split into 1st and 2nd quarter estimates.

26-77. Mineral Raw Materials for Future Security. O. O. Niegarth. *Metals*, v. 17, Nov. '46, p. 6-8.

Strategic Materials Committee has determined that Government should stockpile critical materials to value of $2,100,000,000.

26-78. Sees Antimony Consumption in U. S. Growing; Stocks Down to Low Level; Imports Reduced. James P. Bradley. *Metals*, v. 17, Nov. '46, p. 9-10.

Domestic requirement may reach 46,000 tons annually; stocks held by Government dropped from 23,728 to 5229 tons.

26-79. United States Faces Continued Shortage of Copper, Lead, Zinc and Tin During the Year 1947. Arthur R. Maupin. *Metals*, v. 17, Nov. '46, p. 11-14.

Next year's copper supply estimated at 1,000,000 tons; lead needs believed to be 50% greater than supply.

26-80. Postwar Trends in U. S. Trade—to Midyear 1946. Grace A. Witherow. *Foreign Commerce Weekly*, v. 25, Dec. 7, '46, p. 6-19.

Extensive export and import statistics, broken down to individual commodities and groups, presented in tables and graphs, together with discussion of future trends.

For additional annotations indexed in other sections, see:

1-79; **27**-170.

27 NEW BOOKS

27-170. Minerals Yearbook, 1944. 1636 p. Bureau of Mines, Washington, D. C. (Also Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.) $3.00.

Volume departs from 1943 edition in but one main respect—the chapter on International Aspects of War Mineral Procurement has been greatly expanded so as to include a section on Foreign Minerals Review, with particular emphasis on Latin-American countries. (Review from *Materials & Methods*, v. 24, Nov. '46.)

27-171. Fuels, Combustion and Furnaces. John Griswald. 494 p., McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. $5.50.

Text suitable for the fourth year of a chemical engineering curriculum. Covers fundamental background and more essential specific details of the technology, combustion properties, and utilization of fuels, as well as the apparatus and equipment involved. Includes a large number of tables, diagrams and pictures, problems and references following each chapter, and an extensive appendix of tables.

27-172. The Influence of Port Design on Openhearth Furnace Flames. J. H. Chesters and M. W. Thring. Special Report No. 37, Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W. 1, England. Free to members; 16s. to non-members.

Experiments made to determine the influence of various design factors on combustion, heat transfer, and gas flow. External factors, such as the gas and air flow, gas quality, preheat temperatures, gas pressures, CO_2 in waste gases, and metallurgical load were carefully measured, and various instruments were used to study internal radiation. Flame location, velocity and stability, together with the rate of mixing of the gases, were studied by means of slow-motion films, and by a multiple sampling probe inserted through the roof.

27-173. Spectrographic Analysis of Metallurgical Products. 92 p., Centre de Documentation Siderurique, 12 Rue de Madrid, Paris 8, France.

Proceedings of fifth congress of French society for the improvement of methods of spectrographic analysis of metallurgical products. Includes Le Dosage Spectrographique des Faibles Teneurs en Aluminium dans les Aciers Ordinaires et Speciaus, by R. Castro; Causerie sur les Spectrographes, by H. Tardy; Luminosité Comparée du Spectrographe Ziess Qu 24 et du Spectrographe Zelande de Jobin et Yvon, by E. Loeuille; and Le Dosage des Traces d'Impurétés dans les Alliages de Zinc au Moyen de l'Etincelle Condensee, by P. Croissant.

27-174. Outline of the History of the Academy of Sciences of U.S.S.R. Technical Sciences. I. P. Bardine, editor. 68 p., Academy of Sciences of U.S.S.R., Moscow. (In Russian.)

Reviews research work at the Academy from its foundation to the present in applied science, namely: power engineering, fuels, mining, metallurgy, mechanics, mechanical engineering, automatic control engineering, electric welding, radio, transportation, and problems of water utilization. Also covers scientific nomenclature and the history of technology.

27-175. Proceedings of the Seventh Annual Forum Porcelain Enamel Institute, 1945. 141 p., Porcelain Enamel Institute, Chicago, Ill. $2.00.

Papers include: "Preparation of Sheet Metal for Porcelain Enameling" by B. T. Sweely; "Nickel Dipping" by G. H. McIntyre; "Milling and Mill Additions" by G. H. Spencer-Strong; "Reclaiming Enamels" by Herman L. Cook and William D. Caldwell; "Dipping and Spraying" by J. E. Hansen; "Drying and Firing" by A. I. Andrews; "The Application of Electrostatic Spraying to Porcelain Enamel" by L. G. Goldberg; "Color Standardization and Problems Involved in Matching Paints and Porcelain Enamels" by Norman F. Barnes; and "Spraying Vs. Dipping Ground Coat Enamels" by Paul E. Gerdes.

(Turn to page 48)

NATIONAL MEETINGS *for February*

Feb. 18-20—Magnesium Association. Magnesium Exhibit sponsored jointly by the U. S. Army Air Forces and the Magnesium Association, Wright Field, Dayton, Ohio. (T. W. Atkins, executive vice-president, Magnesium Association, 30 Rockefeller Plaza, New York, N. Y.)

Feb. 24-28—American Society for Testing Materials. 1947 Spring Meeting and Committee Week, Benjamin Franklin Hotel, Philadelphia. (R. J. Painter, A.S.T.M., 1916 Race St., Philadelphia 3, Pa.)

New Brass Die Casting Co.

Blue Ridge Pressure Castings, Inc., a new company established in Lehighton, Pa., will operate high-pressure die-casting machines exclusively on production of brass castings, mainly for the plumbing and hardware trade.

Thomas C. Wilson, as manager, and Allen B. Behler, as superintendent, will head the Blue Ridge Co., Mr. Behler working chiefly on alloying and die casting problems. Mr. Wilson, a metallurgist, will continue to concern himself with development work on die casting alloys and die materials.

Transferred to Dain Mfg.

Robert F. Last, who has been employed in the testing and research laboratories of Deere & Co. since 1936, has been transferred to Dain Mfg. Co., a subsidiary of Deere & Co., as plant metallurgist.

Lindberg Opens New Branch

Lindberg Steel Treating Co., Chicago, announces the opening of a branch plant located at 620 Buffalo Rd., Rochester, N. Y. The new plant has facilities to offer complete heat treating services.

CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	Feb. 17	Engineers' Club	R. A. Wilkins	
Birmingham Dist.	Feb. 4		Howard Scott	Factors Affecting Strength of Metals
Boston	Feb. 7	Hotel Sheraton	A. L. Boegehold	Correlation of Recent Data on Hardenability
Calumet	Feb. 11	Phil Smidt & Sons, Whiting, Ind.	L. P. Rothenthaler	Sheet Metal Drawing
Canton-Massillon	Feb. 5	Belden Hotel, Canton	A. L. Boegehold	Correlation of Recent Data on Hardenability
Cedar Rapids	Feb. 11	Hotel Roosevelt	Victor Stefanides	Discussion of Toughness With Reference to Cutting Tools
Chicago	Feb. 13	Chicago Bar Assoc.	Gosta Vennerholm	Developments in Iron and Steel Castings
Cincinnati	Feb. 6	Engineering Society	G. P. Witteman	Machinability
Cleveland	Feb. 3	Cleveland Club	A. L. Boegehold	Correlation of Recent Data on Hardenability
Columbus	Feb. 11	Fort Hayes Hotel	Mr. Larsen	Welding
Dayton	Feb. 12	Engineers' Club	Hans Ernst	Recent Research in Machinability
Des Moines	Feb. 11	Des Moines Technical School	Harley Wilhelme	tomic Energy
Detroit	Feb. 10	Rackham Bldg.	A. L. Boegehold	Correlation of Recent Data ardenability
Fort Wayne	Feb. 10	Chamber of Commerce	Howard Stagg	Toolsteels
Georgia	Feb. 3	Atlantic Steel Co.	L. C. Grimshaw, R. P. Kells	Selection and Heat Treatment of Tool and Die Steels
Hartford	Feb. 11		A. H. d'Arcambal	Information Please
Lehigh Valley	Feb. 7	Hotel Bethlehem	B. F. Shepherd	P-V Test
Los Alamos	Feb.		K. L. Clark	Casting Technology During the War Years
Louisville	Feb. 4		Richard Kennedy	American Vs. Foreign Materials
Indianapolis	Feb. 17	Marott Hotel	Elbert A. Hoffman	Cold Finished Bars to Physical Property Specifications
Mahoning Valley	Feb. 4	Poland Country Club	A. L. Boegehold	Correlation of Recent Data on Hardenability
Milwaukee	Feb. 18	City Club	Local Talent	Information Panel
Montreal	Feb. 3	Queen's Hotel	R. J. Anderson	Production Application for Inert Gas-Shielded Arc Welding
Muncie	Feb. 13	Muncie Central High School	F. F. Vaughn	Induction Hardening
New Haven	Feb. 20	Dunham Laboratory, Yale University	J. O. Almen	Metallurgical Aspects of Rapid Heating Versus Conventional Heating
New Jersey	Feb. 17	Essex House, Newark	Donald J. Reese	Modern Engineering Cast Iron
New York	Feb. 3	Bldg. Trades Bldg.	Zay Jeffries	Nonferrous Metals
North West	Feb. 13	Curtis Hotel, Minneapolis	D. A. Nemser	Effect of Structure on Machining Steel
Notre Dame	Feb. 12	Notre Dame Eng. Auditorium	Paul Ffield	Materials Engineering in Shipbuilding
Ontario	Feb. 7	Royal Connaught Hotel, Hamilton	A. H. Lewis	Heat Treatment of Iron and Steel
Philadelphia	Feb. 28	Engineers Club	C. H. Samans	Precious Metal Metallurgy
Pittsburgh	Feb. 13	Mellon Institute	A. L. Boegehold	Correlation of Recent Data on Hardenability
Rhode Island	Feb. 5		D. A. Nemser	Fundamentals Involved in Specifying a Steel
Rockford	Feb. 26	Hotel Lafayette	Oscar Frohman	Modern Bronzes
Springfield	Feb. 17	Sheraton Hotel	V. E. Lysaght	Microhardness Testing
Syracuse	Feb. 4	Onondaga Hotel	Gregory Comstock	Powder Metallurgy
Terre Haute	Feb. 10	Indiana State Student Union Bldg.	F. G. Tatnall	Strain Gages and Testing Methods
Texas	Feb. 18	Houston Country Club	A. L. Feild	Stainless Steel and High-Temperature Alloys
Toledo Group	Feb. 26		H. J. Babcock	Interrupted Quenching
Tri-City	Feb. 3		O. R. Hills	Springs and Spring Materials
Tulsa	Feb. 11		G. D. Johnston	Heat Treating—Salt Bath Application
Washington	Feb. 10	Garden House, Dodge Hotel	George Kiefer	Corrosion
West Michigan	Feb. 17	Rowe Hotel, Grand Rapids	R. B. Seger	Heat Treatment of Steel
Wichita	Feb. 13		George D. Johnston	Application of Salt Baths to Heat Treatment of Steel
Worcester	Feb. 12	Hotel Sheraton	Leo Tarasov	Grinding Cracks
				Plant Visitation to Norton Co.
York	Feb. 12		Roger W. Clark	Welding

23-126. The Place of Research in the [illegible]

27-176. Le Cobalt. Robert Perrault. 151 p., Dunod, Paris. 390 francs.

A brief history of cobalt is followed by a description of the various minerals in which it is found. Several methods of extracting the metal are given and flow diagrams illustrate these processes. Other chapters cover properties and applications with emphasis on cobalt's employment as an alloying constituent in steels and other alloys. A final chapter on economic considerations and a bibliography complete the volume.

27-177. Metallizing Handbook. 86 p., Metallizing Engineering Co., Inc., Long Island, N. Y. $2.00.

Data on preparation of surfaces, metallizing technique and finishing procedure, corrosion resistance, specific gravity, hardness, bond strength, tensile strength and relative shrink.

27-178. Machine Operation Times for Estimators. Joseph C. Derse. 156 p., Ronald Press Co., 15 East 26th St., New York, N. Y., $6.00.

Directly usable presentation of procedures for determination of machine and operation times for a wide range of work. Methods for applying the standard elemental times in making detailed estimates. Case examples for numerous typical jobs are worked out in full detail, with drawings of parts, diagrams of tool setups and detail estimate sheets filled with selected data. (From review in *Steel*, v. 119, Dec. 9, '46.)

27-179. Report on Ferrous and Nonferrous Data. Compiled by A. E. White and C. A. Siebert. 591 p., Office of Technical Sciences, Department of Commerce, Washington. $40.00 for photostat edition and $6.00 for microfilm edition.

Based on information available as of September 1941. Report consists of seven volumes of data, classified in two main sections, nonferrous metals and alloys, and ferrous alloys. Each group subdivided according to alloy types; composition, heat treatment, tensile test data and impact properties are given. (From review in *Steel*, v. 119, Dec. 9, '46.)

27-180. Mechanical World Year Book 1946. 360 p., Emmott & Co., Ltd., 21, Bedford St., Strand, London W.C.2, England. 2s, 6d.

Pocket-size manual of information on machine-shop practices, light alloys, plastics, bearings, steam boilers, turbines, internal-combustion engines, welding, and other topics of interest to manufacturers and mechanical engineers.

27-181. Mechanical Measurements by Elecrical Methods. Howard C. Roberts. 357 p., illus., Instruments Publishing Co., Inc., Pittsburgh, Pa. $3.00.

Lists and describes the basic principles of circuits and systems and discusses their applications. The 330 bibliographical references cover the most useful published material. Methods described are most useful to the civil or structural engineer and the stress analyst.

27-182. Proceedings Second Annual Spring Meeting, June 13, 1946. 86 p., Metal Powder Association, New York, N. Y.

Papers include: "Use of Graphite in Iron Powder Compacts" by E. S. Glauch; "Furnace Atmospheres for Sintering" by H. M. Webber and A. G. Hotchkiss; "Sintered High Density Tungsten and Tungsten Alloy Parts" by Jack Kurtz; "Fundamental Facts About Iron Powder Costs" by B. T. DuPont; "Testing Methods in Use in Determining the Properties of Iron Powders" by J. E. Drapeau, Jr.; "Some Relationships Between Properties of Iron Powders and Properties of Parts Made From Them" by F. V. Lenel; and "Physical Properties of Parts Made From Iron Powders" by C. G. Goetzel.

27-183. Proceedings of the Society for Experimental Stress Analysis, v. 4, no. 1. 1946. 129 p., Addison-Wesley Press, Inc., Cambridge 42, Mass. $5.00.

Twelve papers on theoretical and experimental stress analysis.

27-184. Qualitative Analysis by Spot Tests. Fritz Feigl. 574 p., Elsevier Publishing Co., Inc., New York.

Present edition includes the newer spot reactions, together with details of the pertinent procedure and applications. Attempts to assemble and present the entire literature on spot test analysis in readily available form. Includes a chapter on detection of free elements and a bibliography on the applications of spot reactions.

27-185. Use of Tools. 1945. 258 p., United States Government Printing Office, Washington, D. C.

Illustrated Navy Training Course book gives instructions for the care and use of common tools. Begins with advice on the handling of such general purpose tools as hammers, screwdrivers, pliers, punches, and wrenches. It explains the use of the tools used for cutting and shaping metal—chisels, hacksaws, files, snips, drills and reamers. Chapters are devoted to threading tools, pipe and tubing tools, woodworking tools, measuring tools, gages and indicators, soldering and welding tools, special tools, metal fastening devices, and abrasives.

Materials Index

The following tabulation classifies the articles annotated in the A.S.M. Review of Current Metal Literature according to the metal or alloy concerned. The articles are designated by section and number. The section number appears in bold face type and the number of the article in light face.

General Ferrous

1-77-81; **2**-153-156-159-160-164-165-166; **3**-261; **4**-130-131-132; **5**-76-77-78; **8**-154; **9**-144; **16**-131; **17**-55; **18**-269-272; **21**-107; **22**-586; **23**-343; **24**-206; **25**-126; **26**-75-76; **27**-172-179-182.

Cast Iron

3-247; **8**-148; **10**-157; **14**-313-320-321-330; **23**-356; **25**-127.

Cast Steel

3-260; **14**-315-318-329-331; **18**-256-261-265.

Wrought Carbon Steel

3-252; **4**-134; **6**-156; **7**-354-369-375-376; **8**-146-148; **10**-150; **12**-194; **18**-256-259-261-262-267-271; **19**-301-306; **20**-503-509; **22**-574; **23**-337-358; **24**-198-199; **25**-130.

Alloy Steel

3-255-259-263-264; **4**-125-135; **6**-149; **7**-369; **9**-146; **10**-139; **18**-274; **22**-569-571-572; **23**-332-336-340-349-350.

Stainless and Heat Resisting Steel

3-251-263; **6**-142-149; **18**-260; **19**-321-322; **20**-506; **22**-561-573-583-588-595; **23**-333-336-345-348-356.

Toolsteel and Carbides

3-258; **5**-73; **18**-263-270; **20**-505-510-517-527-537; **23**-356; **24**-205.

General Nonferrous

2-154; **8**-150; **16**-126-132; **19**-299; **22**-569; **23**-353; **27**-179.

Aluminum

2-158; **3**-252-257; **4**-122-124-127; **7**-357-360-365-368-371-378-381-389-391-396; **8**-145; **10**-143-150-151-154; **11**-102; **14**-316-326; **15**-31; **18**-253-268; **19**-302-316; **20**-527-531; **21**-105; **22**-562-565-575-578; **23**-338-344-351-354; **24**-201-210.

Magnesium

2-155-158; **3**-248-257-265; **4**-126-136; **6**-145-150; **7**-378; **10**-143-147; **18**-255; **19**-313-315; **22**-562; **23**-341-347-351; **25**-135.

Copper, Brass and Bronze

1-74-75-80; **3**-250; **4**-129-133; **6**-132-144-147-154; **8**-148-158; **10**-142-145-154; **14**-324-333; **15**-29; **19**-301-304-306-311; **20**-495-520; **22**-582-596; **23**-343; **26**-79.

Nickel and Nickel Alloys

3-246-254; **5**-75-77; **6**-148-149; **7**-394; **8**-139-144-149; **10**-139-141-144-145-146.

Lead and Lead Alloys

1-78-80-82; **2**-157; **10**-145; **19**-311; **23**-331-343; **26**-79.

Tin and Tin Alloys

2-157; **4**-126; **8**-146-151; **19**-311; **21**-107; **26**-79.

Zinc and Zinc Alloys

1-80-82; **3**-265; **6**-141; **7**-362-374; **8**-146-151; **10**-141-142; **14**-317-334; **15**-29; **19**-307-311; **22**-565; **26**-79.

Miscellaneous and Minor Metals

1-76-78; **2**-158; **3**-248; **4**-126-129; **5**-77; **6**-133; **7**-394; **8**-139-140-143-149; **8**-162; **10**-134-136-137-138-139-140-146-148-155; **18**-254; **22**-568; **23**-335; **25**-128; **26**-78; **27**-176-182.

WANTED—ENGINEER
with unusual qualifications

Basic work is coordination of data from company's research and from installations of especially-engineered equipment for variety of exact industrial processes. Vision with active interest and enthusiasm for creative developments is essential. Knowledge of established combustion techniques with sound background in at least one art—perhaps metallurgy—required. Successful applicant will be able to show personal examples of scientific writing, as in articles published or in papers presented before engineering societies. An unusual opportunity. Please send reprints or photostats of representative reports or papers. Review experience fully and identify occupational and personal references who may be approached. BOX I-38

Chipman Exhibits Metallic Uranium

Reported by Roy E. Woodbury
Metallurgist, Republic Steel Corp.

John Chipman (Facing Camera) Shows a Group of Interested Listeners Small Rods of Metallic Uranium and Beryllium, Following His Talk at the Mahoning Valley Chapter on Dec. 10. Dr. Chipman, who is head of the department of metallurgy at Massachusetts Institute of Technology, spoke on the laboratory development of the atomic bomb. He presented some of the metallurgical problems in the solution of the nuclear chain reaction, the basic principle of the atomic bomb. Dr. Chipman's talk was detailed in two chapter reports printed in the December issue of Metals Review

Terre Haute Members See Glass Plant Operations

Reported by Kenneth Uran
Columbian Enameling and Stamping Co.

A recent inspection trip through the plant of the Owens-Illinois Glass Co. at Terre Haute proved to be of extreme interest to the A.S.M. Chapter membership. The trip included all the phases of bottle plant operation along with the handling of raw materials. Particular interest was evidenced in the large quantity of beverage bottles being processed.

At the Dec. 9th meeting, J. M. Black of General Electric Co.'s Cincinnati office gave an excellent presentation of atomic-hydrogen welding as well as a discussion of the more recent development along the line of inert gas welding using argon as a protective medium. Mr. Black called attention to the fact that neither of these methods will replace acetylene or ordinary arc welding where those methods can be used.

Arcos Opens New Welding Lab

Arcos Corp. of Philadelphia, manufacturers of electrodes and rods for welding and cutting stainless steels and alloys, has completed a new laboratory building adjoining its plant to house its research and engineering department.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad will be printed. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

POSITIONS OPEN

METALLURGIST: N. Y. area. Tech. work in the field of stainless steels. Applicant must be energetic, cooperative. Should have practical exp. with stainless steels and in tech. writing. In reply include details regarding training, exp., personal information, ref. and salary expected. Box 1-5.

RESEARCH METALLURGIST: Preferably a young man with some exp. in X-ray diffraction of steels, to do research work on low alloy constructional steels, toolsteels, stainless and high alloy steels, for eastern steel mfr. State details of education, previous exp., ref., and salary expected. Box 1-65.

PHYSICAL METALLURGIST: College degree preferably in met. 3 to 5 yr. exp. in metallography essential. Research and development program on new alloys for high temperature. Exp. in high temp. alloys not essential, but ability to understand fundamentals and to work as a useful member of a research team must be demonstrated. Salary $75 per week. New York area. Box 1-75.

SALES REPRESENTATIVE: In northeastern U. S. by midwest stainless steel fdry. specializing in corrosion resisting stainless steel castings. Other territories also available. Box 1-80.

SALES ENGINEER: Young man with engineering background for position of sales engineer in heat treating furnace field in Mich. territory. Opening due to retirement of present employee. Box 1-70.

RESEARCH FELLOWSHIPS: Available to qualified candidates for M.S. and Ph.D. degrees in physical metallurgy. Midwest University. Box 1-90.

METALLOGRAPHIST: Experienced in heat resistant alloys and able to supervise research work leading to the development of new alloy systems. Should be able to devise new techniques and relate metallographic evidence with behavior of metals in use. Salary open. Give description of experience, salary desired, etc. Box 1-85.

POSITIONS WANTED

METALLURGIST: Age 27; B.S. Notre Dame. 2 yr. phys. met. research. 3 yr. plant met. Exp. in lab. supervision and production processes. Desires responsible position in development or plant met. work. East preferred. $4000 min. Box 1-10.

MECHANICAL DESIGNER: Graduate mech. eng. 16 yr. exp. in design, research, drafting room supervision and mfg. Last 13 yr. in home appliance eng. dept. of large electrical appliance mfg. Desires responsible position in design research, drafting supervision, or eng. dept. with progressive established firm. Age 34, married, free to move. Box 1-15.

HEAT TREATER: 25 yr. practical exp. in heat treating all grades of carbon and alloy steels, fully capable of taking charge of dept. Open for engagement with progressive co. West Coast location preferred. Box 1-20.

SENIOR METALLURGIST: Alexander Mitinsky, chief materials engr. of Russian railroads 1912-18; professor of met. at Przibrom, Czechoslovakia, 1918-40; research director of Skoda Works 1924-43; organizer of UNNRA University for displaced persons in Munich (3060 students), is available for consultation or employment by American firm. For further information address Capt. L. E. Forbes, I-E Staff School, Headquarters USFET, A.P.O. 757, New York.

RESEARCH ENGINEER: Veteran, age 27, married. M.S. in Met. Eng. 2 yr. practical exp. as research engineer, met., organizer of met. lab., tool eng. 2 yr. U.S. Army Ordnance Dept. Box 1-25.

METALLURGIST: 14 yr. executive exp. in foundry and mfg. Excellent ref. Age 38, married, excellent health. Salary open. Desires position in St. Louis area, but would consider other localities. Box 1-30.

WELDING CONSULTANT: Prominent welding engr., M.E. degreee, nationally known author of books on welding, authority on eng. materials and fabricating processes, seeks responsible position with consulting eng. firm, metal fabricating industry, construction, or educational institute. P.O. Box 33, Baldwin, N. Y.

POWDER METALLURGIST: Ch. Eng. Several years exp. as powder metallurgist in charge of engineering, development and production of ferrous and nonferrous powdered metal parts. Exp. in the mfg. of tungsten from the ore to finished product. Age 46. Desires New York City area, but will consider others. Box 1-40.

VETERAN: 3 yr. commissioned service in Navy. B.S. in Met. Eng. Postgrad. credits. Limited sales and business administration exp. Age 25, married. Desires position leading to sales engineering or administration in Midwest or West Coast area. Salary secondary to position. Box 1-45.

GRADUATE METALLURGIST: Age 30. Desires position as metallurgist in progressive firm in Midwest. 6 yr. exp. in heat treatment, localized hardening, service failure investigation and metal fabrication problems. Considerable exp. in the use and specifications of alloy constructional steels. Ref. furnished. Box 1-50.

SALES or SALES MANAGEMENT: Seasoned sales eng., industrial furnaces, temp. controls, physical testing machines and heat treating supplies. Exp. includes sales management and complete management for 12 yr. Will consider representation as mfr.'s agent. Good following in Ohio and western Pa. Also known in Ill., Ind. and Wis. Will relocate. Box 1-55.

METALLURGIST: B.S. in Met. Age 36. 5 yr. exp. in nearly all phases of steelmaking, rolling, etc. 3½ yr. in fabrication field. Served as chief met. in charge of 36 personnel. Desires responsible position in steel fabrication. Box 1-60.

PICTORIAL REVIEW OF

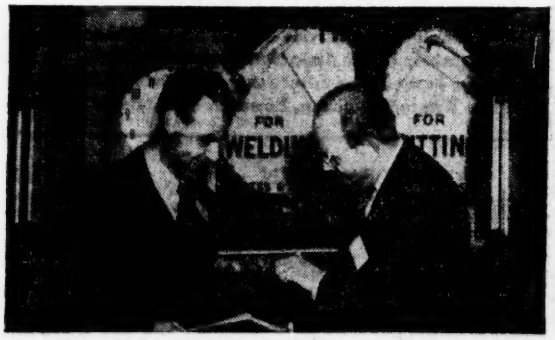
John F. Wilson, advertising manager (left), and Harry Osborn, sales manager, Ohio Crankshaft Co., Cleveland, solving a problem at the Tocco exhibit

Robert S. Strimel of Tinius Olsen Testing Machine Co. (left), the company's vice-president, Tinius Olsen, 2nd (center), and a prospective customer

James D. Corfield (right) of the Michigan Steel Casting Co., Detroit, enjoys a good exhibit

Left to right, C. W. Kahnl, F. G. Tatnall, and Paul I. Irwin, all of Baldwin Locomotive

John A. West, gen. supt. (left), and A. E. St. John, adv. mgr. (right center), Federated Metals Division, American Smelting & Refining Co.



H. B. Snyder, advertising manager, Arcos Corp. (left), discusses a new development with the Arcos advertising agent, Otto Renner

Reading from right, C. H. Stevenson, Les Shea and Harry O. Munn of Lindberg Engineering Co. with J. S. Meyer and W. B. Schoonover of I. B. M. Corp.

Don L. Wyatt, advertising manager (left), and Robert G. Singleton, technical advisor, both of Nelson Sales Corp., Lorain, Ohio

METAL SHOW PERSONALITIES

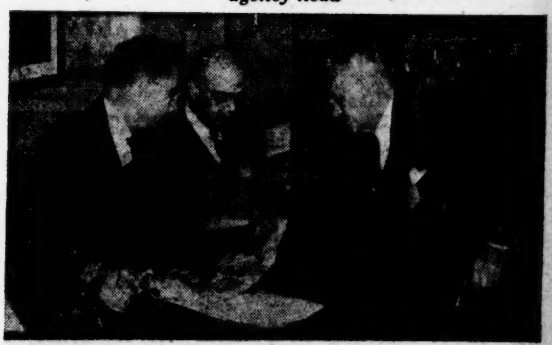
E. H. Stau, sales manager, Cherry Rivet Co., (left), with G. S. Simpson, Jr. (center) and L. L. Maitland

W. H. Eisenman explains the mysteries of heat treating at the Lindberg Engineering Co. booth

H. B. Brown, Jr. (center), sales manager of Superior Tube Co., explains the advantages of tubing to a customer at the Atlantic City show

C. E. Herington, mgr., sales engineering dept., Meehanite Metal Corp. (left), and Brad Wright Smith, Cleveland agency head

W. A. Darrah (center) and Russell Hastings (right), Continental Industrial Engineers, Chicago, discuss a furnace problem with Harry C. Armin



Herbert H. Watjen, sales manager for Lepel High Frequency Laboratories, Inc. (center), shows two prospective customers the advantages of induction heating

From California came George F. Staley, sales manager, the Stoody Co. (right). At left is E. C. Colewaert, Cincinnati, Ohio

A. L. Gardner, advertising manager of Pangborn Corp. (right), and Edwin Bremer, foundry executive, relax in the Pangborn exhibit

NEW PRODUCTS IN REVIEW

BEARINGS, BABBITT

"How To Pour Bearings" is title of two-color, illustrated wall card. With a series of six cartoon-type pictures, the steps necessary to secure good, tightly lined bearings are made clear and easy to follow. Instructions are printed on card stock suitable for hanging in the shop.

Mention R-188 for Reader Service
JOSEPH T. RYERSON & SON, INC.,
16th & Rockwell Sts.,
Chicago, Ill.

BOOTH, PAINT SPRAY

New catalog describes water tube spray booth and contains the working principle and complete specifications. Comprehensive descriptions are amplified by numerous pictures and clear drawings.

A complete and pre-assembled unit, the booth is said to eliminate 80 to 90% of the assembly time normally required on delivery. Greater efficiency is claimed, too, because pre-assembly permits trial runs prior to shipment, thus guaranteeing peak operation performance at first run in the customer's plant. Discharge fan is built-in and entire unit occupies small floor space.

Mention R-162 for Reader Service
NEWCOMB-DETROIT CO.,
5741 Russell St.,
Detroit 11, Mich.

BORING, PRECISION

Line of solid Kennametal squares, designated Style SS, for precision boring of steel, cast iron, and nonferrous metals is supplied bottom side diamond

ground, with 10° formed angle on one end. They may be ground to any desired tool point shape.

Style SS tools are available from stock in Grade K5H for precision boring of steel parts, and Grade K6 for machining cast iron. Catalog sizes are: 3/16 or ¼ in. square x 1¼ in. long; 5/16 in. square x 1½ in. long; ⅜ in. square x 1¾ in. long. Other grades and sizes can be supplied.

Mention R-163 for Reader Service
KENNAMETAL, INC.,
Latrobe, Pa.

CASTINGS— FLAME HARDENING

New booklet outlines in detail many advantages of E-4 flame hardening cast steel. Basic idea behind E-4 is its widespread adaptability to various types of dies, because of inherent characteristics which permit one-piece cast construction and simplification of hardening the cutting or wearing edges without expensive heat treating procedure, and with minimized distortion.

E-4 is an air hardening steel which can be hardened to an exceptional degree at selected sections by simple methods, and which has initial properties, as shipped, of high strength, toughness, ductility and hardness.

These features are covered in the booklet, along with illustrations of many actual applications. Beyond its ideal application in dies, many other uses are recognized for E-4 and its special properties—in the machine tool, road machinery, glass plant, steel mill and other fields.

Mention R-164 for Reader Service
DETROIT STEEL CASTING CO.,
Detroit 10, Mich.

CASTINGS, STRENES METAL

New eight-page booklet illustrates numerous Strenes metal castings. These are largely dies, employed for almost everything that includes drawing and forming operations—appliances, automobiles, bicycles, burial vaults, blowers, caskets, fans, implements, tractors, and trucks. Also illustrated are parts castings such as pump shells, impellers, melting pots, and bushings. Text is brief and free from technicalities.

Mention R-165 for Reader Service
ADVANCE FOUNDRY CO.,
125 Seminary Ave.,
Dayton 3, Ohio.

COATING, METAL RACK

New Korolac solution for the coating of electroplating and pickling racks embodies the chemical inertness of Koroseal tank lining. The new product is known as Korolac RX-2500.

A second new development, known as Korolac Primer No. A-208-B, is used in conjunction with Korolac RX-2500, to provide adhesion of the Korolac coating to the metal rack. This primer is brushed onto the rack and areas adjacent to the contact points, thereby preventing contamination of plating baths by carry-over of solutions underneath the protective rack coating.

Coating is white, opaque, and glossy. Hot alcoholic reverse current cleaners and such oxidizing acids as chromic and 40% nitric have little or no effect. The resistance to organic solvent cleaners is also remarkably good.

Mention R-166 for Reader Service
B. F. GOODRICH CO.,
Akron, Ohio.

COATING, SYNTHETIC

Four-page descriptive folder on "Ucilon" gives properties, application data, and typical uses of this protective coating that resists severe corrosive conditions. Developed from improved, inert, synthetic resins, this material is especially advantageous for maintenance work, and for products subjected to corrosive service.

Mention R-167 for Reader Service
UNITED CHROMIUM, INC.,
51 East 42nd St.,
New York 17, N. Y.

CONTROLLER— TEMPERATURE

Ready for control of ovens, stills, baths, presses and coolants, new Electromax fills need for an inexpensive temperature controller which has high sensitivity and versatility and needs practically no attention. Especially designed for those applications where indicating and recording are not required, Electromax signals and controls only, although temperature readings can be taken manually with it at any time.

Instrument consists of a Wheatstone bridge circuit with a vacuum-tube amplifier as the detecter. Vacuum tubes are standard, easily purchased types, require no matching, balancing or other special selection. It's completely a.c. operated—needs no dry batteries or standard cells. The lack of indicating or recording mechanism makes it a practically "zero maintenance" instrument. Temperature-sensitive elements used with Electromax are Thermohms, resistance thermometer bulbs. Length of lead wires does not affect calibration, and the location of Thermohms can be changed whenever desired.

Mention R-168 for Reader Service
LEEDS & NORTHRUP CO.,
4934 Stenton Ave.,
Philadelphia 44, Pa.

CONTROLS— RESISTANCE WELDING

Line of synchronous precision controls for resistance welding machines has been redesigned. All components, plus control station, are housed in one cabinet, making the control easy to install, service, and operate. Designed for spot and projection welding on air, fluid, motor, and foot-operated resistance welding machines. Although arranged for mounting on the right-hand side of the welding machine, it may be placed on the floor, or on a nearby wall or balcony if floor space is at a premium.

Components of the control system, all meeting the new N.E.M.A. standards, include ignitron contacters, a weld timer, electronic heat control, and, as optional equipment, sequence controls and tempering control. Single enclosure is designed so that the control station always faces the operator. All components with the exception of the ignitron contacters are mounted on hinged panels.

Mention R-169 for Reader Service
GENERAL ELECTRIC CO.,
Apparatus Dept.,
Schenectady, N. Y.

NEW PRODUCTS IN REVIEW

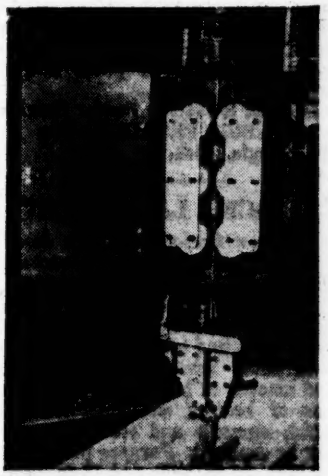
DRILLING, MULTI-SPINDLE

New easily adjustable multi-spindle drilling attachment for drill presses permits the drilling of as many as six holes at one time. Attachment can be easily and quickly installed on most types of drill presses. It comprises a driving head with six movable spindles, each of which is located on an individual radially adjustable arm. The design permits the positioning of drills up to 17/64-in. diameter and any hole pattern, including a straight line, within a 5-in. diameter circle with minimum distance between centers of 11/16 in. From one to six holes can thus be drilled simultaneously in one stroke of the drill press. The housing for drive gears, and the supporting frame and adapters, are of special high strength aluminum alloy and the entire attachment weighs only 13 lb. Modifications of this attachment are also obtainable for special applications.

Mention R-170 for Reader Service
COMMANDER MFG. CO.,
4225 West Kinzie Ave.,
Chicago, Ill.

ELECTRODE—AUTOMATIC WELDING

New type automatic welding electrode is called the Shield-O-Matic. It combines all the advantages of the manual shielded-arc welding process with the requirements for continuous automatic welding. As in the manual shielded-arc electrode, the Shield-O-Matic electrode



combines all the materials necessary for producing a crucible-enclosed welding arc.

A metallic grid construction that binds a heavy flux coating to the wire core provides for the first time, it is said, an electrode that will stand extreme flexing and bending without loss of flux and which can be continuously fed into the mechanically maintained arc from a reel. In that the grid extends to the periphery, welding current is conducted through the heavy coating of flux to the inner steel core.

The fin-ridged construction of the electrode core further provides for the conduction of unusually high welding currents. Its particular design causes electrode and base metal to melt at a much faster rate than conventionally, thus permitting greater economies in metal fabrication, and greater welding speeds.

Welds are made exceptionally uniform by the unique construction of the Shield-O-Matic electrode, in which fluxing agents and the metallic parts of the electrode are combined in a single product to produce a highly stable arc within a crucible.

Mention R-171 for Reader Service
NATIONAL CYLINDER GAS CO., HOLLUP CORP.,
205 W. Wacker Dr.,
Chicago, Ill.

ELECTRODE, WELDING

Under U. S. Patent No. 1,865,169, this firm is manufacturing and marketing a new type of automatic arc welding

(Continued on Page 54)

READER SERVICE COUPON

CHECK THESE NUMBERS FOR PRODUCTION INFORMATION AND MANUFACTURERS' CATALOGS

Use this convenient method to obtain further information on items of interest to you in METALS REVIEW. The following numbers refer to the new products and manufacturers' literature in this issue.

Check as you read—note the number immediately below the item of interest—mark this coupon and mail for prompt handling.

Metals Review, January 1947

R-101	R-109	R-117	R-125	R-133	R-141	R-149	R-157	R-165	R-173	R-181
R-102	R-110	R-118	R-126	R-134	R-142	R-150	R-158	R-166	R-174	R-182
R-103	R-111	R-119	R-127	R-135	R-143	R-151	R-159	R-167	R-175	R-183
R-104	R-112	R-120	R-128	R-136	R-144	R-152	R-160	R-168	R-176	R-184
R-105	R-113	R-121	R-129	R-137	R-145	R-153	R-161	R-169	R-177	R-185
R-106	R-114	R-122	R-130	R-138	R-146	R-154	R-162	R-170	R-178	R-186
R-107	R-115	R-123	R-131	R-139	R-147	R-155	R-163	R-171	R-179	R-187
R-108	R-116	R-124	R-132	R-140	R-148	R-156	R-164	R-172	R-180	R-188

SAVE TIME—GET COMPLETE INFORMATION—CHECK THESE NUMBERS FOR ACTION

PLEASE CHECK PREFERENCE
☐ Send Information for Research or File — Do not have salesman call at this time
☐ Send Information — Salesman may call

YOUR NAME

COMPANY TITLE

STREET CITY AND ZONE

MAIL TO METALS REVIEW, 7301 EUCLID AVE., CLEVELAND 3, OHIO

NEW PRODUCTS IN REVIEW

electrode. Called Raco Composite Type A, this electrode is designed to increase efficiency of automatic arc welding. Among its features are elimination of the necessity of slitting shielded arc coatings to obtain contact with wires, and elimination of the wrapping of shielding materials on the wire during operation. This electrode likewise does away with the recovering of unused melt.

Entire manufacturing process—the drawing of the wire, grooving electrode to permit spiraling of six contact wires, and the coating—is accomplished in one continuous operation.

Mention R-172 for Reader Service
REID-AVERY CO.,
Baltimore, Md.

FANS, CORROSION RESISTANT

New 12-page bulletin on Durco corrosion resistant fans for exhausting acid and other corrosive fumes gives complete engineering data including dimensions and capacities of the five standard sizes of fans. A description of Duriron, Durichlor and Durimet, the special Durco corrosion resisting alloys of which the fans can be built, is included.

Some of the typical applications for the fans are shown by drawings in the bulletin. These include exhausting fumes from laboratory hoods, plating, pickling and anodizing tanks, hydrochloric acid etching installations, reaction kettles, sulphuric acid chamber processes, absorption or drying towers, Kjeldahl tubes, fume washers, etc.

Mention R-173 for Reader Service
DURIRON CO., INC.,
Dayton 1, Ohio.

FINISHING, DEBURRING

New Roto-Finish midget-size machine has been added to this line of finishing and deburring machinery. The midget is designed to permit greater time and labor economies in mechanical finishing and deburring very small parts. It provides greater efficiency in processing large quantities of small parts as well as small lots of parts.

Cylinders are 8 in. wide, 12 in. across the flats. It has a variable drive of 35 to 70 r.p.m. Flats are lined with kiln-dried hard maple, and ends are rubber sealed. Cover is secured to cylinder and cylinder mounted on machine by ingenious lock and adjustable clamp that permits quick loading and unloading. Machine can be supplied without base for bench mounting. Hand parts separator is supplied, and drain connection included. Interchangeable screens are available in all mesh sizes for separation of chips from parts.

Installations where the new Roto-Finish midgets are most suitable are small plating shops, manufacturing plants with small finishing departments, and plants manufacturing very small parts. All mechanical finishing operations may be performed—grinding, deburring, polishing, Britehoning and coloring. The controlled rotary action of the wet mixture of Midget chips and compound produces a surface suitable for plating by removing uniformly burrs, sharp edges and corners on small stampings, machined parts and die castings.

Mention R-174 for Reader Service
STURGIS PRODUCTS CO.,
Sturgis, Mich.

FURNACES, LABORATORY

Two new four-page leaflets describe and picture combustion furnaces for operations up to 2450, 2800 and 3000° F. Leco No. 100 is for carbon analysis, especially where materials are difficult to combust, and where speed is desired. Leco 3000° furnace features quality and amount of insulation, number and size of heating elements, ease with which elements and combustion tubes can be replaced. Furnace proper is 23 in. high, 23 in. wide and 18 in. deep.

Mention R-175 for Reader Service
LABORATORY EQUIPMENT CORP.,
Benton Harbor, Mich.

HONING, LIQUID

Story of Vapor Blast liquid honing, its early development and newly perfected equipment, is presented in "Liquid Honing", V. 1, No. 1. With the discovery and development of extremely fine abrasives and the development of new equipment, liquid honing produced increasingly finer surfaces. Present cabinet design is so adaptable it can be worked up into an automatic conveyer-type cabinet using turntables, fixtures and belts. Tumbling baskets can also be installed. There is practically no limit to the types of fixtures and automatic equipment that can be added to fit liquid honing to the exact needs of any user. It is possible to produce 1000 finish combinations with one unit by a variation in abrasive, compressed air pressure, nozzle size, abrasive mix and the water and chemical emulsion.

Mention R-176 for Reader Service
VAPOR BLAST MFG. CO.,
333 S. 16th St.,
Milwaukee 3, Wis.

HOSE, SANDBLAST

New catalog leaflet deals with sandblast hose, designed specifically for conducting sand and other abrasive materials at high velocities for cleaning, cutting or finishing castings and other metal surfaces. Leaflet describes construction of the product, and gives data on sizes, weight per hundred feet and outside diameters.

Mention R-177 for Reader Service
B. F. GOODRICH CO.,
Akron, Ohio.

INSTRUMENT—TEMPERATURE

New instrument for obtaining accurate surface roll temperatures is known as RollTemp. Essentially a surface pyrometer with delicate indicating instrument separated from the thermocouple, the instrument proper is mounted permanently and conveniently on the machine requiring tests. Operator need handle only the ruggedly constructed thermocouple, thus permitting the layman to take measurements without previous knowledge of instrument care and handling.

Mention R-178 for Reader Service
PYROMETER SERVICE CO.,
230 River Rd.,
North Arlington, N. J.

LUBRICATION, STEEL MILL

New booklet, "Steel Mill Lubrication", deals with centralized lubrication systems as applied to blooming mill operation. It summarizes characteristics a lubricant must possess in order to lubricate all bearings of blooming mill properly. Operation of the blooming mill is featured because this mill typifies many of the lubrication requirements of the steel industry.

Mention R-179 for Reader Service
SHELL OIL CO., INC.,
LUBRICANTS DEPT.,
50 W. 50th St.,
New York 20, N. Y.

ADVERTISERS INDEX

American Chemical Paint Co. 39
B-M Heat Treating Co. 37
Burdett Mfg. Co. 31
Eastern Heat Treating & Brazing Corporation 35
Electro Alloys Co. 33
Harshaw Chemical Co. 29
Hevi Duty Electric Co. 33
Holden Co., A. F. ..... Back Cover
Progressive Welder Co. 41
Richards Co., Arklay S. 39
Ryerson & Son, Inc., Joseph T. 27
Sentry Co. 31
Surface Combustion Corp. 4
Tinnerman Products, Inc. 41
Washington Steel Corporation 2

A. P. Ford, Advertising Manager
7301 Euclid Ave., Cleveland 3, Ohio
ENdicott 1910

Robt. S. Muller, Eastern Representative
55 West 42nd St., New York 18
Chickering 4-2713

Don Harway, West Coast Representative
816 West 5th St., Los Angeles 13
Mutual 6331
68 Post St., San Francisco 4
Yukon 6-1069

NEW PRODUCTS IN REVIEW

NUTS, SPEED

New low-priced line of heat treated spring steel Speed Nuts comprises all the sizes required to fit the ten most popular sizes of machine screws and sheet metal screws. Known as the C7000 series, this new line has been engineered to a precision formula based upon the diameter and strength of the screw with which it is used. As a result, they are more compact, withstand

higher torque tightening, and provide greater tensile strength than any flat-type Speed Nuts heretofore produced. The new C7000 series sells at a lower price than the threaded nut and lock washer.

Mention R-180 for Reader Service
TINNERMAN PRODUCTS, INC.,
2026 Fulton Rd.,
Cleveland 13, Ohio.

PIERCING, FUSION

New method of making vertical blast holes in hard, low-grade iron ore has recently been tested on the Mesaba iron range. Tenfold increases in drilling speeds have been accomplished. In fusion piercing, a flame produced by burning oxygen and a flux-bearing fuel in a special blowpipe is directed against the surface of the rock or ore. The high flame temperature—about 4000° F.—causes some kinds of rock to spall or flake off. Flux in the fuel causes other kinds of rock to melt. Pressure of the burning gases forces the molten material past a water spray where it is quenched and broken up. In the quenching process water turns to steam and the steam helps the gases force the quenched material out of the hole. Fusion piercing is a patented process.

Mention R-181 for Reader Service
LINDE AIR PRODUCTS CO.,
30 East 42nd St.,
New York, N. Y.

SHEARS, POWER SQUARING

New line of all-steel power squaring shears for all types of shearing and trimming up to 14-gage capacities is built from extra-heavy steel plate of box-type design, welded and normalized to relieve stresses. These shears possess maximum strength with minimum deflection.

Standing only 47 in. high, shears have low center of gravity for smooth, vibrationless operation. Cutting length is 73 in., blade length, 75 in. Back gage range is 18 in., front gage range 38 in.; strokes per minute (50 or 60 cycle) 85; 2-hp. motor furnished with each shear; approximate shipping weight, 2750 lb.

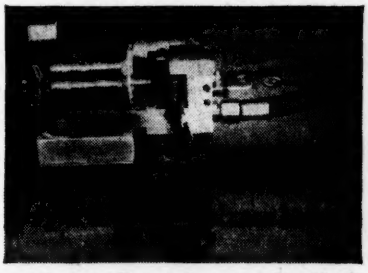
Four-way, high-carbon toolsteel blades last longer and reduce grinding time. Extra long gibways insure long blade life and straight line shearing. Shears will cut drawn or folded parts within 1½ in. of the shoulder; thus deep drawn objects (sinks, basins, cowlings) may be trimmed closer.

Mention R-182 for Reader Service
PARKER MFG. CO.,
2200 Colorado Ave.,
Santa Monica, Calif.

SPRAY GUN, METAL

A metal spray gun for use with low melting temperature alloys is a self-contained precision-type sprayer. It can be used for either intermittent or production spraying and is designed to provide close control of the amount and characteristic of the spray.

Sprayer has seen use in selenium rectifier cell manufacture for applying a finely atomized surface of sprayed metal, as well as in the precision casting field, coating wood patterns and core boxes, production of molds, reproducing parts and producing parts for electroforming. Because of the design of the stainless steel melting pot, intermittent spraying without emptying the



pot during off periods is possible. Metal or alloy in stick form is inserted in the pot through the guide ring and feeds down as it melts. Metal can also be inserted in the gun by using ladle and funnel.

Mention R-183 for Reader Service
METALOY SPRAYER CO.,
135 Liberty St.,
New York 6, N. Y.

TOOLS, CARBIDE

Tools, dies, and wear resisting parts made from Malta cemented carbide and "T and V" cast nonferrous alloy are completely illustrated and described in a new 24-page catalog. Specifications are given for standard Malta carbide tool tips, tools, and wiredrawing dies and for "T and V" cast alloy tool bits.

Mention R-184 for Reader Service
JESSOP STEEL CO.,
Washington, Pa.

TUBES, COMBUSTION

"Zircotube" is the trade name given a new line of zirconium refractory-base combustion tubes, used in carbon and sulphur analysis. New tubes incorporate design and materials carefully chosen and processed to withstand high temperature and thermal shock and resist metal splatter. Three other desirable

characteristics are accuracy in size, gas tightness, and extra long life at high temperatures up to 2800° F. Available in a complete line of sizes, restricted and open ends.

Mention R-185 for Reader Service
HARRY W. DIETERT CO.,
9330 Roselawn Ave.,
Detroit 4, Mich.

WELDERS

Construction details, electrical specifications and application data on complete line of a.c. transformer-type welders are contained in new booklet. Detailed information is given on the 500 and 400-amp. industrial welders for fast, steady production; the 300-amp. welder for heavier-than-average work; and the general duty welders ranging from 20 to 250 amp. Electrical specifications and performance data are presented in chart form for easy reference.

Mention R-186 for Reader Service
WESTINGHOUSE ELECTRIC CORP.,
P. O. Box 868,
Pittsburgh 30, Pa.

WELDING—LOW-TEMPERATURE

How to save money by using low temperature for welding is the subject of new 32-page booklet that tells about savings resulting from use of low-temperature welding. It also serves as a catalog and instruction guide for the company's products, including rods especially designed for work on cast iron, steel, stainless steel, copper, copper nickel, nickel bronze, and other copper-bearing alloys, zinc-base die castings, and aluminum; a galvanizing powder for cast iron, a powdered brazing compound, and fluxes.

Mention R-187 for Reader Service
ALL-STATE WELDING ALLOYS CO., INC.,
96 West Post Rd.,
White Plains, N. Y.

New! HOLDEN MARQUENCHING *furnace*

1. New design doubles the surface radiation losses, dissipates heat from work being quenched.
2. Complete recirculation of the bath in from two to four minutes depending on size of furnace.
3. More production per square foot because hot salts are removed at the surface of the bath by vertical pumping.
4. Molten salt or hot oil circulates around the top of the furnace to the sump and is force-cooled at this point by air for salt, or water coils for oil.
5. Controls are used in the sump area as well as in the quenching zone to maintain temperature plus or minus 2° F.
6. The pump bearings are water cooled.

DISTORTION—Martempering or marquenching to produce 50% martensite is the only method to control size and maximum physical properties on SAE or tool steels.

NO CRACKING—Martempering eliminates cracking and distortion on SAE or tool steels.

FILTERS—New Holden principle effectively removes hardening salts, sludge and scale.

SAVINGS—With these new filters no quenching salt needs to be thrown away.

ECONOMY—The salt saving alone pays for the furnace in one year regardless of other savings by eliminating cracking and expensive machining operations.

SEND FOR BULLETIN MR 401

THE A. F. HOLDEN COMPANY, *Metallurgical Engineers* NEW HAVEN, CONN.

WAREHOUSES: DETROIT • CHICAGO • LOS ANGELES

MANUFACTURERS OF HOLDEN PRODUCTS IN CANADA: PEACOCK BROS. LTD. • P. O. Box 6070, Montreal, Canada